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PAPER TRADE JOURNAL

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Vol. CIII AUGUST 13, 1936 No. 7

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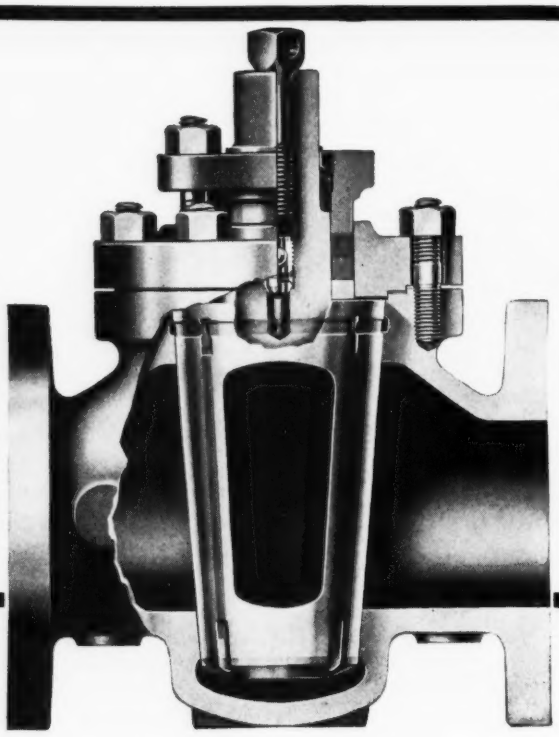

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ESTABLISHED 1872

SIXTY-FIFTH YEAR

THE INTERNATIONAL WEEKLY OF THE PAPER AND PULP INDUSTRY AND THE PIONEER PUBLICATION IN ITS FIELD

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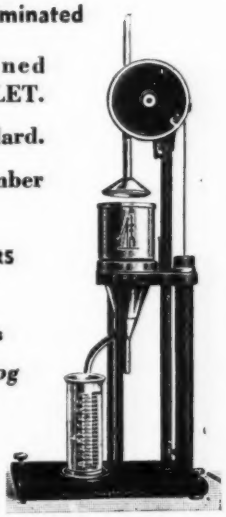

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TAPPI and Canadian Technical Section Meet

Joint International Convention, Including Whole Days at Montreal and Quebec, and a Delightful Steamer Trip Down the St. Lawrence and Up the Saguenay, Attended by More Than Three Hundred Delegates and Friends

[FROM OUR SPECIAL REPRESENTATIVE]

MONTREAL, Que., August 10, 1936—More than 300 delegates and friends gathered at the Mount Royal Hotel, Montreal, Canada, on August 3 for a five-day International Convention in joint session of the Technical Association of the Pulp and Paper Industry and the Technical Section of the Canadian Pulp and Paper Association.

Mayor Houde Extends Welcome

Official civic welcome was extended at the luncheon meeting by His Worship Mayor Camillien Houde, C.B.E., who jokingly wondered why he had been invited. "I had been afraid," he said, "that because I have been in political life for 13 years and have frequently suggested that newspapers should all be suppressed because of their stories, you might consider that I was trying to put your industry out of business." Further welcome was given by Dr. H. J. Rowley, chairman of the Canadian Technical Section, and by W. S. Kidd, general chairman of the international committee in charge of arrangements, while Mr. McInnis extended greetings to the American visitors, who constituted two-thirds of the gathering.

Research Need Stressed

The urgent need for fundamental research into the many problems facing the industry was stressed by the Canadian Pulp and Paper Association president. The newsprint industry was now in the $100,000,000 class, he noted, and it was essential that the companies provide more money for research. If Canadian firms did not do that, he warned, their competitors to the south would leave them behind in the inevitable march of progress.

"The council of the Canadian Pulp and Paper Association, has pondered the matter of research," Mr. McInnis stated, "and has prepared a three-year programme for the Research Institute, which is working in co-operation with the Government and with McGill University. There is need of $50,000 a year to carry on what is considered as fundamental research and I appeal to the various companies to contribute it."

Grellet N. Collins, president of the Technical Association, welcomed the fact that more interest was being taken in fundamental research in the paper industry than before. Canadian newsprint was now emerging from the slough of despond, but unless the United States industrial leaders were careful they were likely to enter the slough through developments in the southern states. As a token of appreciation of the hospitality accorded, Mr. Collins presented the Technical Section C.P.P.A. with a banner, Dr. H. J. Rowley, chairman of the section, accepting it, as a token of goodwill and co-operation.

The luncheon was presided over by W. S. Kidd, general chairman.

The Weldon medal was presented by A. L. Dawe to C. B. Davies of Sault Ste. Marie, and C. C. Heritage expressed thanks to the committee who had made the arrangements for the meeting and to Leo Tobin for the Saguenay tour arrangements. He said the four-day meeting would be unique in that it combined technology with travel.

The Morning Session

Technical papers were read by W. T. Bennett, of Canadian International Paper Company, Gatineau, on "Development of High Speed Paper Machines," prepared with the collaboration of B. Malkin, chief engineer of Dominion Engineering Company, and J. H. Mowbray Jones, of Mersey Paper Company, while L. E. Kendall, also of the Canadian International Paper Company, and R. T. Steedman, of Anglo-Canadian Pulp and Paper Mills, spoke respectively, on the characteristics of ground wood pulp and of sulphite pulp in high speed newsprint manufacture.

The Afternoon Session

In the afternoon, papers in connection with the use of the Minton vacuum drier in newsprint manufacture were read by J. H. Gough, of Price Brothers & Co., who described the operating characteristics, and by Dr. H. S. Hill, of the same firm who treated with the quality of vacuum dried newsprint, while L. T. Stevenson, delivered a study on forecasting paper production.

R. S. Kellogg Speaks on Canadian Newsprint

Royal S. Kellogg, secretary of the Newsprint Service Bureau gave a review of 24 years of the Canadian newsprint industry, limiting his remarks to the period since 1913, first because, he said, there were no complete statis-

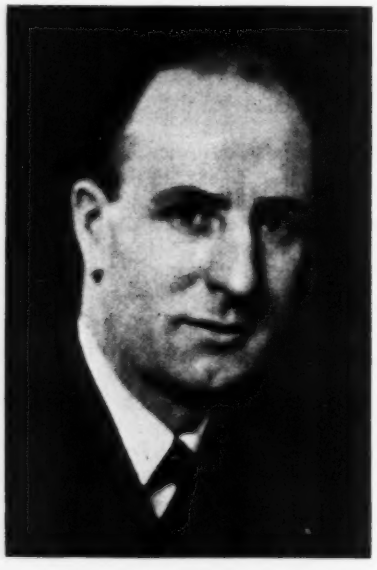
tics available before then and second because with the removal of the U. S. duty on newsprint in that year "started Canadian newsprint going places, which it has done increasingly since that time."

He demonstrated this by saying that in 1913 Canada manufactured 350,000 tons of newsprint paper, while in 1936 the output would be nearly nine times that volume. The peak U. S. production in the United States of 1,680,000 tons was exceeded by Canada in that year by 200,000 tons, and since then, Canada had been the greatest single producer of newsprint paper in the world. A new high record of 3,000,000 tons or more was in the making this year, or 40 per cent of the estimated world output.

Exports Increase

In 1913 Canada exported 73 per cent of its newsprint, last year exports had risen to 94 per cent, and an even greater proportion was anticipated in 1936. The export to the United States was now permanently over the 2,000,000-ton mark and Canada was supplying 64 per cent of the 3,500,000 tons of newsprint that the United States would use this year.

Mr. Kellogg claimed that the paper industry was one of the strongest factors making for peace and friendship between the two countries, and quoted an authority that there was over $4,000,000,000 of American money invested in Canada. In 12 years up to 1930 there had been 91 new machines added to the Canadian industry, and the world had never seen anything like this record, and probably never would again.



W. S. KIDD
Chairman, General Committee

On the other side of the picture Mr. Kellogg pointed out that the great machine-building boom, followed by decreased consumption during the depression had put nearly 60 per cent of the Canadian newsprint industry into receiverships, defaults or similar financial straits from which it was yet far from recovered. But he counselled the technicians that they should continue hopefully, for there were no formidable substitutes for pulp and paper and more than ever the technicians would be needed as the industry progressed.

An Excellent Program

The excellent program arranged by the committee provided for a full day of technical meetings and the presentation of papers at Montreal and a four-day cruise on the S. S. *Quebec* down the St. Lawrence and up the Saguenay Rivers, stopping at Quebec, Murray Bay, Tadoussac and Bagotville.

During the delightful moonlight sail down the broad and majestic St. Lawrence on Monday evening, excellent entertainment was provided by Jerry Shea's Orchestra and the Saguenay Singers who remained aboard during the entire trip. Their efforts were well received and the enthusiasm of the guests in joining in the singing and the many encores for dance music which was the outstanding event every evening was indicative of the spirit of goodfellowship which existed and a compliment to the entertainers.

H. J. ROWLEY
Chairman, Technical Section

The boat docked at Quebec on Tuesday morning and many of the members visited the Anglo-Canadian Pulp and Paper Mill, Ltd., at Limoilou, where arrangements had been made to conduct the party in groups with a guide in charge of each group to explain the various operations of this large and modern newsprint mill. A visit was also made to the Donnacona Paper Company nearby.

Golf on the Royal Quebec Golf Course

Those of the members desiring to compete for the R. A. McInnis trophy, had perfect weather for the match over the magnificent course of the Royal Quebec Golf Club at Boischatel. The ladies made tours of historic interest in and around Quebec, visiting the Citadel Fortifications, the City Gates, Battlefield Park, etc. And so after an enjoyable day at Quebec, the party returned to the ship for a delicious dinner and an evening sail to Murray Bay.

Early on Wednesday morning, the golfers were on their way to the Manoir Richelieu Golf Links at Murray Bay. The weather continued perfect but a high wind was a good alibi for some of the scores turned in. Other members visited the Manoir Richelieu and enjoyed a refreshing swim in the outdoor pool.

Quaint Old Village of Tadousac

Back aboard the S. S. *Quebec* for luncheon and a delightful sail to the quaint old village of Tadousac where the life of the habitants has remained unchanged for centuries. There was sufficient time allowed for a visit to

the ancient chapel and the Tadoussac Inn. Along the road, one was greeted by the small children singing their folk songs. All were back aboard ship again for an early evening sail around Cape Eternity and up the famous River of Mystery and Legend—the Saguenay. Cliffs rise to enormous heights on both sides and in many places, the depth is unknown. Approach is made to Cape Trinity as darkness falls and the image on the Cape is picked up by the ship's searchlight. A turn is made in the cove close to the cliffs where the ship's whistle can be heard to echo, first sharply and then diminishing to a rumble which rolls on through the hills until indistinguishable. All hands were on deck in spite of the sharp cold wind to enjoy this unusual experience but quickly deserted the decks as the ship proceeded to Bagotville where it anchored for the night.

Mill Visitations

The program on Thursday provided a full day for the visiting of several plants. An early morning start was made by train to the Price Brothers & Co., Ltd. mill at Riverbend where a committee awaited the train to escort the party to every department of this vast and modern newsprint mill. The company is to be congratulated on the excellent manner in which it expedited the various groups through the mill without confusion and is to be complimented for the courtesy extended by its staff.

The members were guests of the mill at a luncheon served immediately following the visit. Too much cannot be said for their graciousness and hospitality.

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G. N. COLLINS
President of the Technical Association

After leaving Riverbend, a visit was made to the Hydro-Electric plant on the Isle of Maligne. From this point, the members entrained for a visit to the Aluminum Company of Canada at Arvida, where the various operations of producing aluminum were explained and witnessed. It was most interesting and fully appreciated by those attending. At the conclusion of the visit, the party was conducted to one of the buildings where elaborate preparations for refreshments and rest had been provided. Here nothing was overlooked that would appease the appetite, thirst or comfort of the now somewhat tired delegation. It could be observed that many of the guests were satisfied to remain longer than time allowed and it was not until the company's locomotive had tooted itself hoarse that the last of the stragglers boarded the train which returned over the company's own line to Port Alfred and the boat at Bagotville. Only a few ladies were in the party but an interesting program was arranged for those who remained at Bagotville. There was a tour of Kenogami, Arvida and Chicoutimi, also golf and bridge.

As there were no business sessions on Tuesday, Wednesday or Thursday, the technical meetings were resumed on Friday as the ship steamed back to Montreal. These meetings were more in the nature of discussions rather than the usual reading of papers.

Papers Presented

The following papers were presented with G. N. Collins presiding as chairman:

"Contribution to the Knowledge of the Nature of Lignin Derivatives" by Fritz E. Brauns.

R. G. MACDONALD
Secretary of the Technical Association

"A Simplified Method for the Rapid Determination of the Available Chlorine Content of Pulp Bleaching Solutions" by Donald T. Jackson and John L. Parsons.

"System of Rosin Size, Alum, and Fibre as Related to Problems in Paper Making" by S. J. Robinson.

"Relation Between Growth Conditions, Wood Structure, and Pulping Qualities" by C. E. Curran.

"What Constitutes Validity of Patents" by C. W. Rivise.

"Recent Developments in the Field of Coated Paper" by O. W. Callighan.

Visit Dominion Engineering Co.

In Montreal, on their return they were conducted to the plant of the Dominion Engineering Company at which two of the largest newsprint machines are under construction for the new mill being built on the Lower St. Lawrence for the Chicago *Tribune* and New York *Daily News* interests.

All the members and friends who attended this exceptional convention, were unanimous in their high praise for the committee on arrangements, and particularly for the chairman, W. S. Kidd of Eddy Company, Ltd. J. N. Stephenson, editor of the *Pulp and Paper Magazine of Canada* was always in demand as a master of ceremonies and he, with the other members of the committee, are responsible for the enjoyable cruise and the smoothness with which all arrangements for business and entertainment were conducted.

Winners in the Golf Matches

The golf prizes were presented on board the S. S. *Quebec*, on Thursday night, by J. N. Stephenson, editor of the *Pulp and Paper Magazine of Canada.*

E. B. Wardle of the Consolidated Paper Corporation, won the R. A. McInnis Trophy for the best low net for Technical Association members. Mr. Wardle turned in a card of 74 for his play on the Royal Quebec Course, at the Seventh Annual Competition.

The following prizes were won at the golf tournament at the Royal Quebec Golf Course on Tuesday:

First Low Gross—A. J. Campbell, of the American Cyanamid and Chemical Corporation.

Second Low Gross—G. E. Puette, Manchester Board and Paper Company, Richmond, Va.

Third Low Gross—J. S. Babbett, Gair Company, of Canada.

First Low Net—Edward Ahern, R. Hoe & Co., New York City.

Second Low Net—Edgar Wardle, Consolidated Paper Corporation.

Third Low Net—L. L. (Buster) Griffiths, Heller & Merz.

Low Gross for First Nine—D. B. Chant, Ontario Pulp and Paper Makers, Safety Association.

Low Gross for Second Nine—Edward Bearce, Chillicothe Paper Company.

Lowest Score for One Hole—W. H. Monsson, Hooker Electro Chemical Company.

Most Nines—J. B. Gough, Price Brothers.

Most Sevens—L. K. Baber, Richmond, Virginia.

Highest Score for any One Hole—F. H. Lovenberg, Mathieson Alkali Works, K. M. Thorsen, of the Central Paper Company, and William Weed, Electro Bleaching Gas Company, and A. A. Coffin, of Titanium Pigment Company.

Most Pars—J. N. Stephenson, Editor of *Pulp and Paper Magazine of Canada.*

At the afternoon play the following prizes were won:

Low Gross—A. Grant, Pulp and Paper Accessories Company.

Low Net—J. N. Stephenson.

At the play on Wednesday, over the Manoir Richelieu Golf Links at Murray Bay, the following prizes were won:

Low Gross—Ross Puette, Manchester Board and Paper Company.

Second Low Gross—Joseph Dow, Castle & Overton.

First Low Net—Lester Grouse, Pennick & Ford Ltd.

Second Low Net—R. T. Wainwright, Don Valley Paper Company.

Third Low Net—Dr. R. W. Ball, Krebs Pigment and Color Corporation.

Low Gross for the First Nine—A. J. Campbell, American Cyanamid and Chemical Corporation.

Second Low Gross for First Nine—W. S. Mills, Wallace & Tiernan Co.

Most Pars—M. W. Semple, Canadian International Paper Company.

Lowest Score on One Hole—C. E. Curran, Forest Products Laboratory.

Highest Total Score—Ed Turner, International Paper Company, and L. K. Bickley, West Virginia Paper and Pulp Company.

Highest Score on one Hole—W. E. Greene, W. E. Greene Corporation.

Most Eights—K. M. Thorsen, Central Paper Company, and George Bearce, Maine Seaboard Paper Company.

The ladies who won prizes for playing over the difficult Murray Bay Golf Course were:

Low Gross—Mrs. John Traquair.

Low Net—Miss Franklin.

Low Gross for First Nine—Mrs. C. V. Davies.

Low Gross for Second Nine—Mrs. E. F. Bearce.

Low Net for First Nine—Miss B. R. Burland.

Low Net for Second Nine—Mrs. D. B. Chant.

Low Gross for Playing Only One Nine—Mrs. Larry Lynd.

Second Low Gross for Playing Only One Nine—Miss Helen Kiely.

Mr. Howard Kennedy was presented the cup for the Woodland Section in the contest between the Woodland Section and the Technical Land.

The Committees

Following, are those who served on the committee:

THE COMMITTEE ON ARRANGEMENTS

General Chairman—W. S. Kidd, The E. B. Eddy Company, Ltd.

General Secretary—A. E. Cadman, Secretary, Canadian Pulp and Paper Association.

Chairman of TAPPI Committee—C. C. Heritage, Oxford Paper Company.

GENERAL COMMITTEE

G. N. Collins, Stevens & Thompson Paper Company, President of Technical Association of the Pulp and Paper Industry.

R. G. Macdonald, Secretary, Technical Association of the Pulp and Paper Industry.

H. J. Rowley, Anglo-Canadian Pulp and Paper Mills Ltd., Chairman of the Technical Section.

W. R. Maull, Dill & Collins, Inc.

A. A. MacDiarmid, Price Brothers & Co., Ltd.

Chas. Sankey, Ontario Paper Company, Ltd.

J. N. Stephenson, *Pulp and Paper Magazine of Canada.*

LADIES COMMITTEE

Mrs. H. Wyatt Johnston, Convenor, Mrs. W. Boyd Campbell, Mrs. C. C. Heritage, Mrs. H. S. Hill, Mrs. R. S. Kellogg, Mrs. H. J. Rowley.

Ladies' Bridge Parties

Two bridge parties were arranged by the ladies' committee, one on Thursday afternoon while the men were away on the all day mill visiting trip and one on Friday morning while the TAPPI technical session was being held on the ship.

Special prizes were provided by contributions from Consolidated Lithograph and Manufacturing Company, *Pulp and Paper Magazine of Canada, The Paper Mill* and PAPER TRADE JOURNAL.

Winners of prizes on Thursday were Mrs. Holden, Mrs. Bickley, Mrs. Walker, Mrs. Burland and Mrs. Holbrook.

On Friday the winners were Mrs. Harpell, Mrs. Hanson, Mrs. De Cew, Mrs. Burland and Mrs. McDonald.

Technical Papers in Technical Section

The papers presented at the convention will be found in this week's Technical Section beginning on page 69.

Prize Doners

The following concerns donated the prizes awarded to the winners in the various competitions held during the convention:

Ayers Limited, Lachute Mills, Que.

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Canadian Ingersoll-Rand Company, Ltd., Montreal, Que.

Canadian Vickers, Ltd., Montreal, Que.

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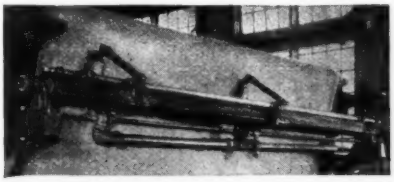

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F. C. Huyck & Sons, Albany, N. Y.

Kenwood Mills Limited, Arnprior, Ont.

Krebs Pigment and Color Corporation, Newark, N. J.

Mason-Neilan Regulator Company, Boston, and Mason Regulator Company of Canada.

National Oil Products Company, Harrison, N. J.

Norton Company, Worcester, Mass., and Norton Company of Canada, Ltd., Hamilton, Ont.

Paper Makers Importing Company, Easton, Pa.

Pulp and Paper Mill Accessories Ltd., Montreal, Que.

Shawinigan Chemical Ltd., Montreal, Que.

J. Spencer Turner Company, Ltd.

United Steel Corporation, Ltd.

Waterous Limited, Brantford, Ont.

New TAPPI Members

The executive committee of the Technical Association of the Pulp and Paper Industry has elected the following to membership:

William Barnhart, production engineer, American Box Board Company, Grand Rapids, Mich., is a 1918 graduate of Yale University and was formerly engineer for the Hayes Body Corporation, Grand Rapids, Mich., and the Auburn Motor Corporation, Auburn, Ind.

Walter L. Blackhall, chemist, New York City, Testing Laboratory of the Department of Purchases is a 1907 graduate of Rensselaer Polytechnic Institute.

Otto Brauns, sulphite superintendent, Algonquin Paper Corporation, Ogdensburg, N. Y., is a 1928 graduate of the Institute of Technology, Stockholm, Sweden, and was formerly with Rydobruk A/B., Sweden, McGill University and the Abitibi Power and Paper Company, Iroquois Falls, Ont.

Raymond F. Cuyle, chemist, Champion Paper and Fiber Company, Canton, N. C. is a 1934 graduate of the New York State College of Forestry.

James M. Farnum, chemist, Taylor & Co., Norristown, Pa., is a 1928 graduate of the Massachusetts Institute of Technology.

Harry H. Heuser, consulting chemist, Perth Amboy, N. J., is a graduate of Muhlenberg College and Cornell University.

Walter R. Hickey, chemical engineer, Detroit Gasket and Manufacturing Company, Detroit, Mich., is a 1934 graduate of the University of Detroit, and was formerly with the Chevrolet Motors Company, Detroit, Mich.

Lena E. Kelly, chemist, American Writing Paper Company, Holyoke, Mass. is a graduate of Smith College and was formerly chemist for the Washington Lamp Company, Bloomfield, N. J. and the Allied Chemical and Dye Corporation, Laurel Hill, L. I., and Baltimore, Md.

Benjamin M. Kimball, general manager, Gilman Paper Company, Gilman, Vt. was formerly with the Claremont Paper Company, Claremont, N. H., the Brompton Pulp and Paper Company, East Angus, P. Q. and the Nashua River Paper Company, East Pepperill, Mass.

Malcolm H. Mc Allister, sales engineer, F. W. Berk & Co., New York, N. Y. is a 1932 graduate of Stevens Institute of Technology and was formerly with the American Chicle Company, New York, N. Y.

Harley E. Nelson, chemist, Nekoosa-Edwards Paper Company, Port Edwards, Wis. is a 1935 graduate of the University of Wisconsin.

Charles B. Norris, consulting engineer, American Box Board Company, Grand Rapids, Mich. is a 1917 graduate of the University of Wisconsin, and was formerly with the Forest Products Laboratory, Madison, Wis. and the Haselite Manufacturing Corp., Chicago, Ill.

Ellis F. Parmenter, research chemist, Eastern Manufacturing Company, South Brewer, Maine, is a 1926 graduate of Colby College and received his Ph.D. from Brown University. He was formerly with the Brown Company, Berlin, N. H.

George A. Richter, research director, Brown Company, Berlin, N. H. is a 1913 graduate of the Massachusetts Institute of Technology.

Louis J. Scheid, chemical engineer, Watervliet Paper Company, Watervliet, Mich. is a 1927 graduate of Michigan State College and was formerly with the Clarage Fan Company, Kalamazoo, Mich., and B. F. Sturtevant Company, Boston, Mass.

Naum L. Shamroy, chief draftsman, Hardy S. Ferguson & Co., New York, N. Y., is a 1922 graduate of Cooper Union, and was formerly with George F. Hardy, New York, N. Y. and Compania Cubana, Ingenio Jobabo, Cuba.

Fred O. Sundstrom, Heller & Merz Div. Calco Chemical Company, Bound Brook, N. J. is a 1930 graduate of Cooper Union, N. Y.

Albert F. Williams, chief chemist, Parker Young Company, Lincoln, N. H. is a graduate of Kenyon College and the Massachusetts Institute of Technology and was formerly with the Brown Company, Berlin, N. H.

Hans E. Woisin, manager, Chemical and Metallurgical Department, American Lurgi Corporation, New York, N. Y. is a 1922 graduate of Bergakademie Freiberg, and was formerly with Silbermine Alte Hoffnung Gottes, Freiberg, Saxony, and Lurgigesellschaft fuer Chemie und Huettenwesen, Frankfurt on the Main, Germany.

Laurence M. Woodside, assistant chemist, International Paper Company, Niagara Falls, N. Y. is a 1931 graduate of the New York State College of Forestry.

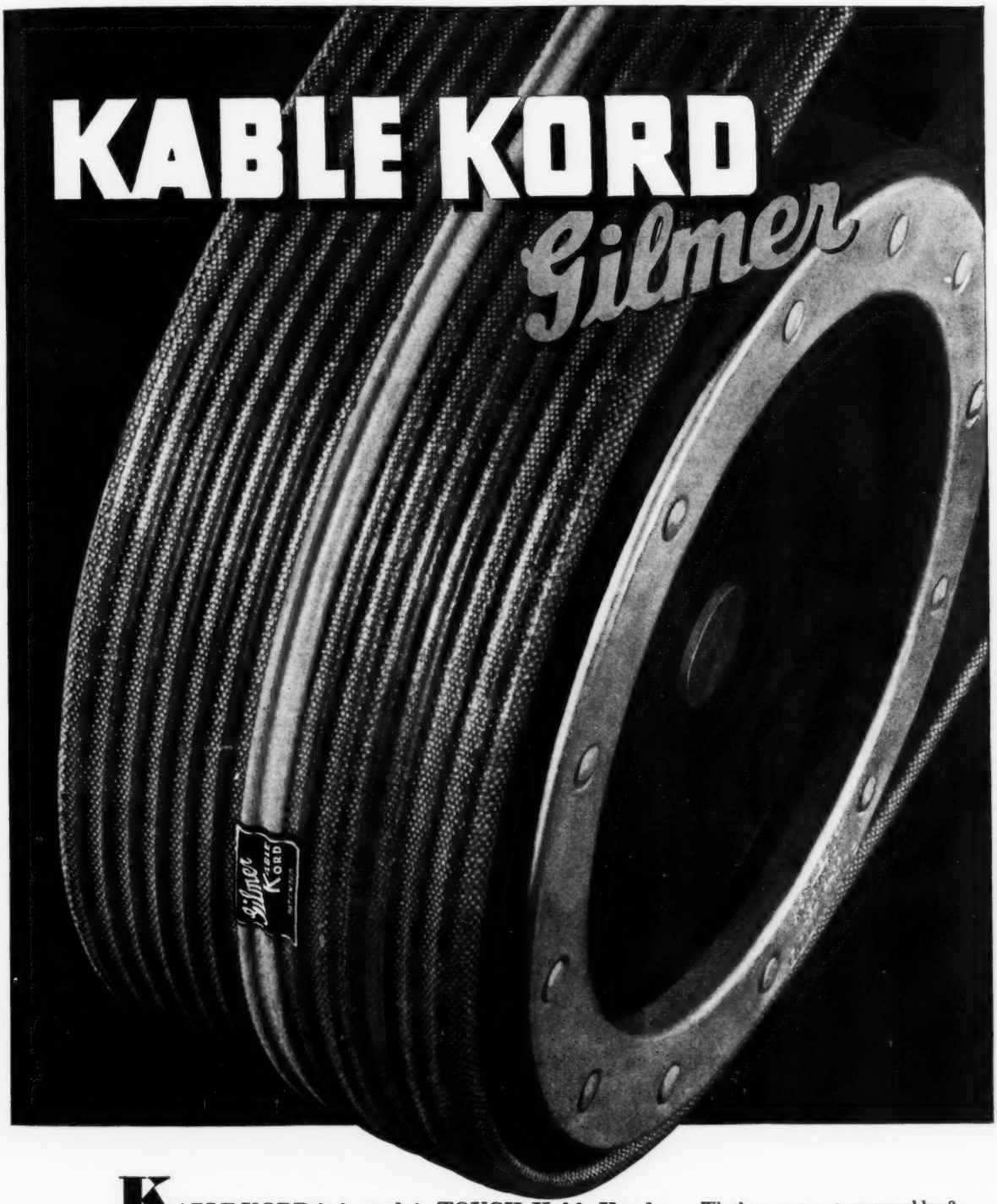
Test Export Market for Pulpwood

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., August 12, 1936.—Possibility to open up an export market in European countries for New Brunswick pulpwood is being tested by the forwarding of approximately 6,000 cords of New Brunswick pulpwood to the Netherlands and Germany says a report to the Department of Commerce from Vice Consul Frederick C. Johnson at Fredericton.

One cargo of 3,000 cords has already been loaded at Newcastle in the Miramichi area and the remaining 3,000 cords have been collected and are ready for shipment.

The present effort to establish a pulpwood market in Europe for New Brunswick products is entirely new and is in the form of an experiment to probe the possibilities of establishing a permanent export market in European countries. If the venture should prove a success it will mean much to the province of New Brunswick in providing greater employment opportunities to overcome the unemployment situation there. For many years the United States provided the only export market.



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Those Who Attended the International Meeting of TAPPI and Canadian Technical Section

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Mr. and Mrs. Edward Ahern, R. Hoe & Company, New York City.
W. J. Alford, Sr., New York City.
W. J. Alford III, New York City.
Mr. and Mrs. L. C. Anderson, Ontario Paper Company, Thorold, Ont.
F. B. Attwood, Container Corporation of America.

B

L. K. Baber, Richmond, Va.
J. S. Babbett, Gair Company, Canada, Ltd., Montreal, Que.
Mr. and Mrs. R. L. Bachelder, Kalamazoo, Mich.
C. M. Baker, Engineer, American Paper and Pulp Association, Madison, Wis.
Mr. and Mrs. R. R. Baker, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.
Robert W. Ball, Wilmington, Del.
P. S. Barnhart, Westfield River Paper Company, Russell, Mass.
A. C. Bate, American Cyanamid and Chemical Corp., New York City.
Mr. and Mrs. H. T. Baughman, West Virginia Pulp and Paper Company, Williamsburg, Pa.
Mr. and Mrs. Geo. Bearce, Maine Seaboard Company, Bucksport, Me.
Mr. and Mrs. E. F. Bearce, Chillicothe Paper Company, Chillicothe, Ohio.
H. L. Becker, Agasote Millboard Company, Trenton, N. J.
Mr. and Mrs. L. C. H. Beigbey, Erie, Pa.
Bennett, G. D.
J. W. Bennett, Dilts Machine Works, Fulton, N. Y.
L. K. Bennett, Gair Thames Inc., New London, Conn.
Mr. and Mrs. W. T. Bennett, Canadian International Paper Company, Gatineau, Que.
L. K. Bennett, Gair Thames Inc., New London, Conn.
Mrs. N. Bent, Jr.
S. Bent.
Mr. and Mrs. H. G. Bickley, West Virginia Pulp and Paper Company, Williamsburg, Pa.
W. H. Birchard, Fraser Companies Ltd., Edmundston, N. B.
Mr. and Mrs. L. K. Bickell, British Columbia Pulp and Paper Company, Port Alice, B. C.
Miss S. Blair, TAPPI, New York City.
Mr. and Mrs. L. M. Booth, Booth Chemical Company, Elizabeth, N. J.
Mr. and Mrs. H. G. Bowne, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.
L. G. Bowne, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.
C. W. Boyce, Secretary, American Paper and Pulp Association, New York City.
Mr. and Mrs. H. A. Brawn, Howard Smith Paper Mills, Ltd., Valleyfield, Que.
F. E. Brauns, Institute of Paper Chemistry, Appleton, Wis.
T. H. Broadhurst, Dominion Engineering Company, Ltd., Montreal, Que.
W. Brubacher, Spruce Falls Power and Paper Company, Kapuskasing, Ont.
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Mr. and Mrs. H. H. Burrows, Manhattan Rubber Company, Passaic, N. J.
John Buss, Provincial Paper Ltd., Toronto, Ont.

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Mr. and Mrs. O. W. Callighan, Edgar Brothers Company, Kalamazoo, Mich.
E. J. Calnan, Ontario Paper Company, Thorold, Ont.
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Dr. and Mrs. W. B. Campbell, Forest Products Laboratories of Canada, Montreal.
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J. E. Carruthers, Interlake Tissue Mills Company, Merritton, Ont.
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T. G. L. Crosswaite, Canadian Pulp and Paper Association, Montreal, Que.
C. E. Curran, Forest Products Laboratory, Madison, Wis.

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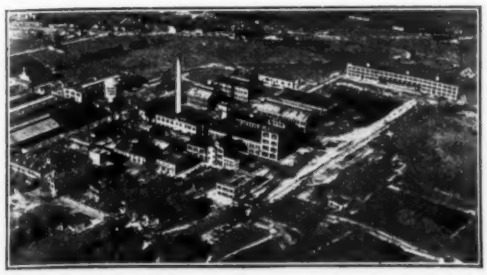

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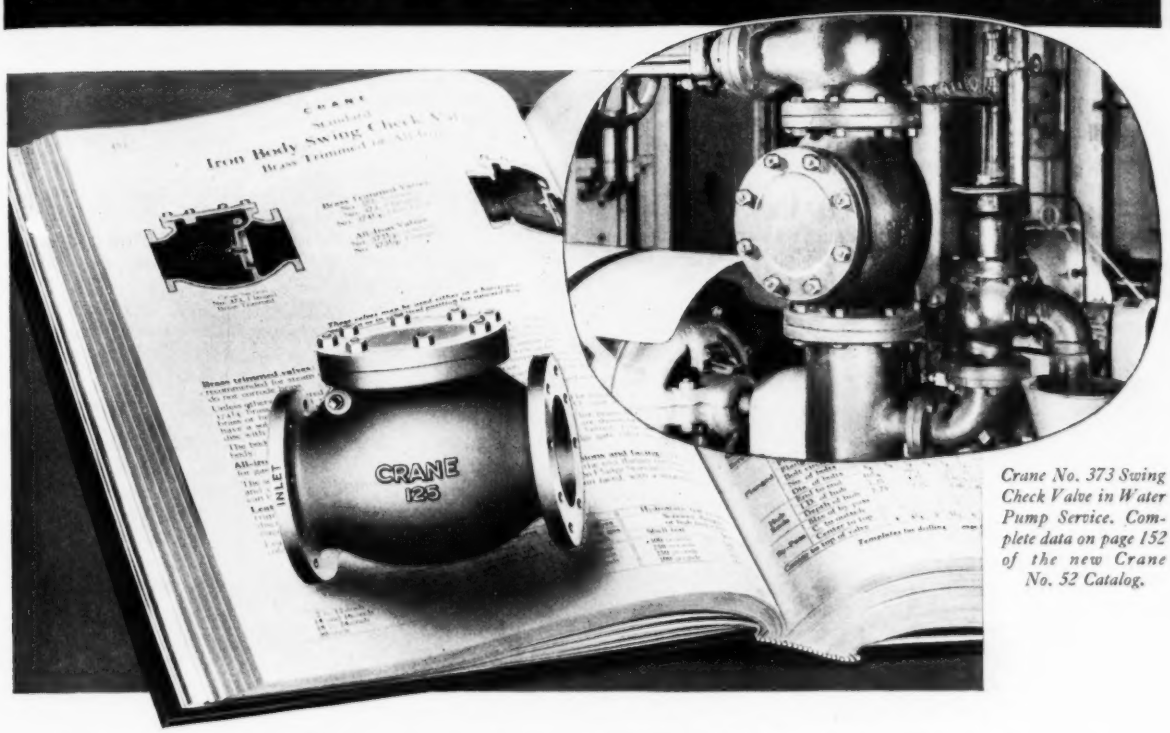

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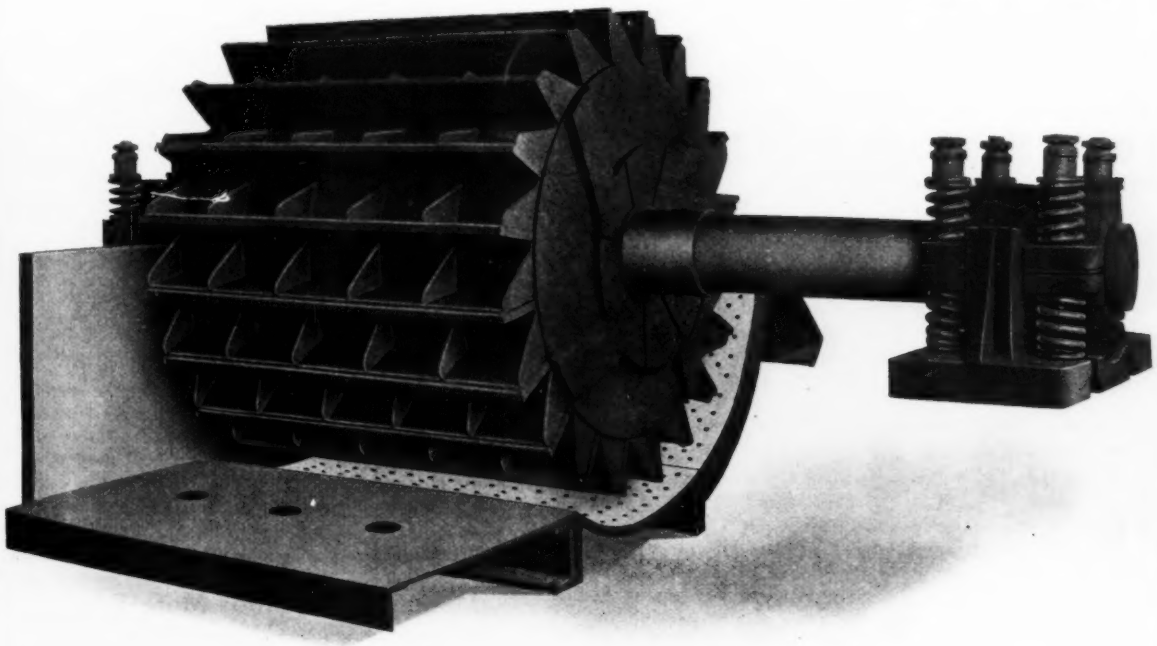

Patented Braced Bar construction, reinforcing each fly bar transmitting shock to base of next adjacent bar.

Maximum extracting capacity using both the perforated bedplate and perforated backfall.

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"Your paper is made in your beaters"

Canadian Newsprint Mills Discuss Price Advance

Increase of $1.50 Per Ton Recently Announced by Great Northern Paper Co. on Contracts for 1937 Deemed Insufficient to Meet Higher Operating Costs—Dominion Producers Reserve Freedom of Action for the Present

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, Que., August 10, 1936.—Leading Canadian newsprint executives held a meeting here on Thursday last to consider the situation resulting from the announcement by the Great Northern Paper Company of a price of $42.50 per ton for its 1937 newsprint contracts, but no statement as to the attitude Canadian mills propose to take was issued.

Meanwhile there is no attempt to minimize the disappointment which the announcement has caused and the feeling is stronger than ever that the days when a single producer can fix the price for the whole industry are numbered. As far as can be accertained the intention of Canadian producers is to reserve complete freedom of action, watch events, and shape their policy as prospects for the coming year permit.

Following the Great Northern Company's announcement newsprint bonds, which had advanced in price from 10 to 15 per cent in July, lost the greater part of the advance, but quickly regained about half the losses.

In some quarters, while it is maintained that it can by no means be taken for granted that the Great Northerns decision will this year be the standard for the industry, it is admitted that the industry may achieve more by a series of small increases which it can maintain than by a wide increase which a reversal in the statistical situation might readily make it relinquish.

The fact that the industry is now operating at a fairly high ratio makes the $1.50 increase, small though it may seem worth more than it would have been a year or two ago when the industry was operating around the 60 percent level. Costs have materially increased in the meantime, of course, as much, it is claimed as $2 per ton in the period over which, including the present prospective increase of $1.50, the selling price has risen $2.50, so that the set benefit to the industry, were the proposed 1937 basis to become general, would be little better than 50 cents a ton.

One Montreal weekly publication, *Financial and Marketing Bureau,* urging that the word had not been said regarding a reasonable advance in the price of newsprint, remarks: "For eighteen months to June 30, last, we gouged and tore at our virgin forests to the appalling extent of 4,000,000 tons of newsprint, while during that same period holders of some $100,000,000 of newsprint bonds received not one cent on their investment, and it is even doubtful if proper depreciation allowances were made during this heyday of 'record output.' "

Paper Ship Launched

A new ship *International I,* for the carriage of paper on the Richelieu and Lake Champlain route, has just been launched at the shipyards at Lauzon, Que. The ship will ply between the Gatineau river and New York, taking paper from the company's mills to the metropolis.

The new vessel is 113 feet in length, with a breadth of 24 feet. She is powered by 180 horsepower Diesel engines, capable of maintaining a speed between nine and ten knots.

The Chambly canal route has come into prominence during the past year. The Donnacona Paper Company called for a survey of the route a few years ago, to determine if power vessels could be successfully operated between the St. Lawrence and New York without the long voyage around the coast. Hitherto, traffic on the Chambly canal had been confined to scows, and trade on the route had dropped off sharply in later years.

Nothing was done immediately after the survey, but last year the Donnacona company laid down at the Davie shipyards the first power vessel for the route, and named her the Donpaco. Operation of the ship was successful, and this spring the same paper company ordered another of the small Diesel-powered vessels. She was launched recently and named the Papercarrier.

With the launching of the *International I,* another paper firm enters the service, and it is expected that several more ships will be built for the route by firms having mills on, or near, the St. Lawrence river.

Draft of the vessels must necessarily be light, as the Chambly canal is shallow. Good time is maintained by the ships now running in the service.

Lake St. John Earnings Improve

Because a permanent reorganization of its funded debt and share capital is contemplated for the near future, Lake St. John Power and Paper Company, Limited, did not make payment on account of accumulated interest on August 1, as was generally expected. Improvement in earnings and in working capital position is reported. The company was acquired on June 4, 1930, by St. Lawrence Corporation through an exchange of common stock.

Miami Valley Ships More Paper

[FROM OUR REGULAR CORRESPONDENT]

DAYTON, Ohio, August 10, 1936—For the first time in the history of the Miami Valley Paper Shippers' Association's history, March and April moved into the group of ten million pound months in pool tonnage totals. Last year it was May before the monthly figures leaped above the 9,000,000 mark, and they stayed there until November. This places 1936 two months ahead of last year.

The total pool car and truck tonnage for March was 10,747,000 pounds an increase of 8.4 per cent over the same month a year ago. In addition, 19 more cars and 82 more trucks moved to 16 more destinations than in March, 1935.

The April figures show an increase of four destinations over the previous month and 16 destinations over April, 1935.

The total number of destinations was 42, only one less than the all-time record of 43 destinations set in August, 1935.

Paper mill men and association officers say that this serious threat at the record indicates it should soon be broken.

The April tonnage this year was 10,192,000 pounds in 124 cars and 436 trucks. It shows an increase of 4.4 per cent over the same month one year ago.

Not just 3 or 4 "talking points"...but A Whole Bale of Performance Features

GREATEST - TEAR - FOLDING - TENSILE - BURSTING STRENGTHS

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STORA 32

In many vital respects Stora Quality 32 is different than any other bleached pulp on the market. These features are basic advantages — not claims of questionable value or importance. Many paper mills have already learned the true extra values in Stora Quality 32. You too, can find many ways to use it to advantage.

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Demand for Paper Fairly Active In Boston

Volume of Sales Transacted Considered Favorable for Summer Season—Request for Various Grades of Fine Paper Irregular—Supplies of Wrapping Paper Moving Freely Into Consumption—Paper Stock Situation Firmer

BOSTON, Mass., August 10, 1936.—The volume of sales made by paper houses was very favorable for the summer season. While a few in the fine paper division noted that it was a little quiet, others said it was fair and good. The demand for tag stocks, both in the white and natural, continued. In wrapping paper, there was considerable movement. The boxboard market continued steady.

The paper stock market, on the whole, was very firm, particularly in certain lines. The few price changes which took place, were all upward. In old papers, old newspapers, for which there was a good demand, moved from a flat .30 to a flat .32½. Corrugated boxes advanced to .47½ @ .50 from a flat .47½. There was a fair movement in bagging.

Under new domestic rags, new white shirt cuttings, new light flanellettes and blue overalls were much sought, with prices remaining firm. Old domestic rags held their own. In foreign rags, there was not much activity. With Europe in turmoil, prices are so high that they have not been accepted on this side.

News of the Industry

The Arnold-Roberts Company is distributing the Riverdale Cover sample book, issued by the American Writing Paper Company, Holyoke, Mass. The manufacturers have made improvements in this cover, which can be relied upon to print easily, speed up production and turn out clean, attractive, economical jobs. It is suitable for catalogs, broadsides, folders, menus or similar uses. The cover has strength, folding qualities and a lint-free surface. Riverdale is made in three weights and three sizes and in white and the following colors: Fawn, India, red, gray, blue, buff, green, granite, mandarin, brown and yellow. The sample book is of Riverdale Cover, blue, Antique 23x35—248M. Copies of the book may be obtained by getting in touch with the Arnold-Roberts Company.

Another book being distributed by the Arnold-Roberts Company concerns Strathmore Rhododendron Cover, put out by the Strathmore Paper Company, Woronoco, Mass., in plastic binding. This cover is for a great variety of work, including catalogs, booklets, broadsides and folders. This cover is particularly suitable for men's stores and fashion shops, as well as for the tougher assignments of industry. It is strong, durable, permanent and attractive. Rhododendron folds well, has uniformity of wire and felt sides and is fast to light. This cover is available in both Telanian and antique finishes. It has a natural feathery deckle edge and is made in white and the following colors: Sepia, Orient ivory, Indian gold, frost gray, smoke gray, Neapolitan blue, chocolate, dusk blue, Pompeian red, leather brown, pyro brown and woods green. The samples in the swatch show various plate and art treatments. The cover of the sample book is of Strathmore Rhododendron Cover, antique finish.

The Arnold Roberts Company is also distributing a new bond paper sample book, showing Baypath Bond, made by the Strathmore Paper Company.

No. 8 of a series of Consumer Pamphlets being distributed to the printers by the Arnold-Roberts Company, to increase their business and help create more printing, has been released by the West Virginia Pulp and Paper Company. Inspiration No. 100, made by the West Virginia Pulp and Paper Company, is a demonstration of coated and uncoated cover, sent to the printers by the Arnold-Roberts Company. It can be had for the asking.

W. C. Hamilton & Sons, Miquon, Pa., manufacturers of fine paper, announce the appointment of Charles H. Dodge as New England representative with offices at 10 High street. The plant of this concern is one of the best handled and best equipped. The moisture content of their papers is regulated. One of the very few large springs of the country gives an unfailing supply of excellent paper-making water. A highly interesting and instructive booklet on "Pre-Humidified Paper," by H. H. Hanson, of W. C. Hamilton & Sons and Albert Allen, of the Atlantic Precision Instrument Company, is issued.

Joseph D. Snell, of the Von-Olker Snell Paper Company, is enjoying a vacation by taking short trips around New England.

E. H. Sussenguth, acting manager of the New England office of the American Writing Paper Company, has gone to Cape Cod with his family for a vacation.

Fred Herbolzheimer, in charge of the fine paper department of the Andrews Paper Company, is enjoying a vacation, part of which is at York Beach, Me.

Ontario Paper Industry News

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, Ont., August 10, 1936—Arthur E. Craig, former president of the Firstbrook Box Company, Toronto, died on August 1 in his sixty-sixth year. He had been ailing a long time. He was a member of several prominent clubs and was widely known in executive and sporting circles. He is survived by his widow.

St. Lawrence Paper Mills has been ordered by the court to pay the city of Three Rivers $31,363 for taxes due three years ago. The city sought payment for $50,295 for municipal taxes imposed in 1933. The court ordered full payment of paving and property taxes but refused a claim for a highway levy.

Orville H. Moore, of Toronto, former managing director of the Hinde & Dauch Paper Company of Canada, who has been associated with paper making for forty-eight years and for over thirty years was chief mechanical engineer in the erection of paper making plants, delivered an interesting address before the Rotary Club of Huntsville, Ont., last week on "How Paper is Made." Mr. Moore is now retired and travels extensively in all parts of the world.

The Howard Smith Paper Mills, Ltd., are erecting a chemical plant near Cornwall, Ont. The building will be two stories high, of concrete and brick construction.

In the rag and paper stock market the situation is strong on all grades, with the exception of book and ledger. The supplies are short but sufficient. The hot weather recently interfered with collections, but these are now improving. The demand is about ten per cent ahead of last year. The situation is well controlled and there is not much immediate chance of increased prices.

CALL FOR SPECIMENS 1936

American Institute of Graphic Arts

SPECIFICATIONS AND CONDITIONS

1. SPECIMENS may be submitted by the designer, printer, advertising agency, or the client for whom executed, and must have been produced in the United States or Canada since September, 1935.

2. ALL specimens must be sent prepaid and addressed to: Commercial Printing Committee, American Institute of Graphic Arts, 115 East 40th Street, New York.

3. EACH specimen submitted must have a separate slip attached, bearing the following information:
Name and address of Exhibitor (stating whether designer, printer, advertising agency, or client for whom executed).
Classification of entry.
Title.

4. SPECIMENS must be postmarked not later than the closing date, September 15th.

5. ONLY *one* copy is required at the time of submission, but one *additional* copy must be available in case the entry is selected for hanging.

6. SUBJECT to the conditions embraced in the "Statement of Aims and Platform" below, any piece of commercial printing is eligible which does not exceed a flat size of 22 x 28 inches.

7. SPECIMENS will not be returned unless such request accompanies entry and return postage is enclosed.

8. THE term "printing" is understood to include any and all commercial reproduction processes such as: letterpress, lithography, offset, rotogravure, photogravure, photo-gelatine, etc.

FIVE CLASSIFICATIONS

ENTRIES will be judged and exhibits shown under five classifications, as follows:

1. Booklets, books (for advertising), catalogs, house organs.
2. Folders and broadsides.
3. Stationery and forms.
4. Display and novelty pieces.
5. Publication advertisements.

ANNUAL EXHIBITION OF

Commercial Printing of the Year

SPECIMENS MUST BE RECEIVED BY SEPTEMBER 15

DATE AND PLACE OF EXHIBITION

THE exhibition will be opened in New York on Tuesday, October 20th. It will run through Saturday, November 7th, at the Architectural League, 115 East 40th Street.

TRAVELING SHOW

AFTER the opening in New York, the exhibits will be shown in cities throughout the country. This traveling exhibition has for years been a feature wherever it has gone. It is viewed by thousands interested in the graphic arts.

AWARDS OF MERIT

CERTIFICATES of Merit will be awarded for all entries that may be selected for hanging. This selection will be made by a distinguished jury, representative of all phases of the graphic arts.

HANGING FEE

A HANGING fee of two dollars will be charged for each specimen that is accepted by the jury to be shown in the exhibition.

STATEMENT OF AIMS AND PLATFORM

IN order to clarify the basis on which exhibits are selected and principles on which awards will be made, the following platform has been adopted:

1. THIS exhibition is intended to be a record of the best commercial printing of the year.

2. IT embraces material which has been produced chiefly through the arts and processes commonly included in the graphic arts. That is, it embraces printing or printed processes distinguished in any or all of the following elements: LAYOUT, DESIGN, COLOR, TYPOGRAPHY, PRESSWORK, PAPER, BINDING.

3. THE basis of selection is two-fold: first, the standards of good taste, creative excellence, and craftsmanship for which the A. I. G. A. stands; second, the practical application and effectiveness of each piece for the purpose intended.

4. THE merit or lack of merit in text or "copy" of the entry is not a factor — only the suitability of the printed vehicle to the message it carries.

5. WHILE pieces produced as examples or demonstrations will be accepted, preference will be given pieces which have been produced and sold as commercial jobs.

6. THE exhibit is not concerned with periods or styles, with modernism or classicism — but only with appropriateness and with practical application.

COMMERCIAL PRINTING COMMITTEE

TEXT—EGMONT MEDIUM, INTERTYPE CORPORATION.
DISPLAY—CITY COMPACT BOLD, CONTINENTAL TYPE FOUNDERS ASSOCIATION, INC.
NAME LINE—GILLIES GOTHIC BOLD, THE BAUER TYPE FOUNDRY, INC.
LAYOUT—WERNER HELMER.

Chicago Paper Business Continues to Improve

Demand for the Various Grades of Paper Expands With the Approach of Autumn—Fine Papers In Comparatively Good Shape—Book and Cover Papers Slightly More Active—Sulphite Bonds Exhibit Stronger Undertone

[FROM OUR REGULAR CORRESPONDENT]

CHICAGO, Ill., August 10, 1936.—Slowly but surely Chicago market conditions continue to improve as the Fall season approaches. The month of August gets favorably underway in most of the reported grades with activity in waste paper lines and strength of pulps adding to the cheerfulness of the news.

Fine papers had a comparatively good week, with strength in certain lines, including sulphite bonds, acting as a tonic for the entire list. Books and covers were slightly more active, with the book mills giving indication of a broadening of activity. Kraft papers continued strong and the underlying demand inquiries were considered good. Board markets encountered the usual seasonal improvement which reflected on certain grades of waste paper in the local market. Newsprint representatives here were said to be somewhat disappointed at the size of the price advancements for the next year but still optimistic over the long term outlook. Groundwoods were only in fair demand but slightly improved over last week. Mixed papers were reported about the same by local waste dealers though news was slightly stronger.

News of the Industry

Bradner-Smith & Co., has reported the lions share of new lines introduced into the Chicago market this week. The big west side paper jobbers announcements included mention of Chester Vellum and Old Cairo Anno, made by the American Writing Paper Company; some new features in the Nationwide papers group including Compass Ledger, Nationwide E. F. and Eggshell; Distaff Linen from the mills of Crane & Co., and Reply-O Blotters. The Nationwide additions represent the newest achievement of the group of jobbers who organized a non-competitive distribution unit some months ago.

Ray Harrington, for a quarter of a century prominently identified with the Kalamazoo Paper Company of Kalmazoo, Mich., has recently opened offices in Chicago at 343 South Dearborn street. Mr. Harrington, who was sales manager for Kalamazoo, is to serve as a manufacturers representative for a number of lines of quality paper in non-competitive fields. At the present time announcements have been made concerning his representation in this territory of the Beveridge Paper Company and Hawthorne Paper Company lines.

H. B. Gerber, for a number of years identified with the Miami Paper Company, is now associated with the Williams-Gray Company, with offices at 221 North LaSalle street, Chicago.

Some Chicagoans are planning on participating in the week-end fund built around the annual Chinese Paper Makers party at Trout Lake, Wis. Some clever announcements, with the Chinese "motif", have been circulated to drum up a good crowd and members of the paper and pulp industry from this territory are showing plenty of interest. Grover Keeth, Marathon Paper Mills, Rothschild, Wis., is in charge of a program which includes luncheon, golf and a wind up party at Little Bohemia.

The Midwest Division of the Salesmens Association of the Paper Industry held its weekly meeting at the Hotel Sherman on August 3. Most of the meeting is reported to have been taken up with a good natured discussion of the golf prowess of various members and with the record attendance of 93 members and guests who journeyed to Knollwood last week for the third in the series of monthly golf events.

The Heco Envelope Company, Chicago, has recently distributed to the trade two samples of the new line of envelope stocks known as "Silver Fibre," a strong paper which has the appearance of cover paper and compares favorably with gray bonds when used in smaller commercial sizes. Silver Fibre is carried in a wide range of weights for immediate deliveries. Samples were sent out to the trade on silver Fibre, 24 substance.

The Illinois Legislature is again in special session, this time considering ways and means of financing the present relief crisis, particularly in Chicago. The chief concern of the Chicago and Illinois retail and jobbing paper trade is to guard against any increases in the sales tax or any levying of other taxes to be utilized as "emergency measures" to aid the relief problem. Local executives are most anxious to see a complete check-up of all cases on relief and to see the administration costs of relief properly "pegged." When this is done, and a system of re-qualification set up, then local executives are reported to be in sympathy with solving the relief situation on a permanent basis.

Temperature Control Units

The principles, operating details and methods of application of the Stabilog Potentiometer Control Pyrometer are described in comprehensive fashion in Bulletin 194-1, recently published by the Foxboro Company, Foxboro, Mass. Related equipment for automatic temperature control is also covered.

Following a brief review of the potentiometric method of temperature measurement, the bulletin goes on to explain how this method is effectively combined with the Stabilog air-operated continuous control system. It outlines the unique operating principles in both the measuring and control systems which are said to increase accuracy, prevent "hunting," offset lag conditions and give smooth control by analyzing the rate of temperature change taking place in the process work under control.

A discussion of the recording unit, which provides a running check on temperature maintenance and rate of control readjustment aids in determining the worth of this feature in specific applications. In addition, the bulletin describes the advanced Stabilset control system, which meets abnormal processing conditions by a combination of two or more Stabilogs, one resetting the control point of the other. Valves with flow characteristics specifically designed for use with air-operated control units are considered, since valve flow characteristics must maintain a definite relation to the controlling air-pressure changes.

The bulletin also contains specifications and ranges of thermocouples, resistance bulbs and other accessories, thus providing a complete reference guide for selection of modern equipment for continuous temperature control from —300 deg. F. to +2800 deg. F. Copies are available without charge from the Foxboro Company.

West Virginia Installing New Power Plant

Williamsburg, Pa., Mill Will Include High Pressure Boilers, Steam Turbine and Switching Equipment—Changing Over From Steam to Electric Drive on Two Paper Machines, Utilizing Electronic Type Regulators

[FROM OUR REGULAR CORRESPONDENT]

PHILADELPHIA, Pa., August 10, 1936 — West Virginia Pulp and Paper Company, at their Williamsburg, Pa., mill is installing a new power plant including high pressure boilers, steam turbine and switching equipment. At the same time they are changing over from steam engine to electric drive on their two paper machines. The electric drives will utilize the Westinghouse electronic type regulators to provide the best speed regulation obtainable. Their program of modernization also includes the installation of variable voltage electric drives on two supercalenders.

Pusey & Jones Corporation, of Wilmington, Del., is now building the new high-speed Kraft machine for the Southern plant of West Virginia Pulp and Paper Company. The new machine will be of the most modern design and will be driven by a Westinghouse sectional electric drive. The winder will be driven by a variable voltage drive including the use of a braking generator for automatic tension control on the unwinding stand.

Outlook for Paper Industry Bright

This week, instead of discussing trends, etc., your correspondent devoted quite a bit of time gathering impressions from those in the trade here—large and small—to find out how business is with them and how they feel about the outlook for the near future. It makes a heartening story. One hundred per cent report business better than a year ago. Some say very much better, others just moderately better, but all agree that business in all lines is better. As to the outlook, all expect to see business increase materially this fall and winter.

Dill & Collins Open Downtown Office

For the convenience of buyers, Dill & Collins, Inc., book paper manufacturers, have opened a downtown office in the Ledger Building, 6th and Chestnut streets. W. R. Ingersoll, sales manager of the firm, is in charge of the new office.

It was announced at the same time that an additional floor is being built at one of the finishing buildings of the firm's plant at Richmond and Tioga Streets to provide new quarters for the company offices. The mill offices are now in a building somewhat removed from the plant. The new quarters will contain approximately 6,400 square feet of floor space and will be ready for occupancy in a little more than a week. This new addition will provide for offices for Vice-president M. G. Benson and Treasurer C. E. Barnard; also general offices of the company. Sydney Ferguson, president of Dill & Collins, Inc., maintains his office at 230 Park Avenue, New York.

Dill & Collins traces its origin back to 1690, when the first paper mill in America was built on the banks of the Wissahickon Creek by William Rittenhouse.

The firm deals in both coated and uncoated papers. Among its better known coated grades are Black and White, Printflex and Dilfold. The Philadelphia distributors are Thomas W. Price & Co., Raymond & McNutt Company, Wilcox-Walter-Furlong Paper Company and A. Hartung & Co.

Among the products of the firm are papers for booklets, bulletins, envelope enclosures, house organs, broadsides, covers and envelopes. The various finishes range through the whole category of glossy coated, English finish, felt, antique, supercalendered smooth uncoated, ripple and fancy finishes. Some of these are produced in as many as eight distinct colors, offering a wide range of choice to printers and advertising buyers.

Gilbert Wall Paper Petition

On petition of Paul J. Gilbert, president, and F. L. Gilbert, secretary-treasurer, of the Gilbert Wall Paper Company, Judge Ray P. Sherwood has assumed jurisdiction of the final liquidation of the wall paper firm.

Accompanying the petition of the two officers, who are the only directors of the company, is a liquidation account which shows receipts of $27,369.18; disbursements of $11,116.70, and remaining for distribution $16,252.48.

There are a number of large claims of creditors which are disputed. Because of these claims, and as the corporation is insolvent, the petitioners requested the court to assume supervision of continued liquidation proceedings so that claims of all parties entitled to participate in the distribution may be judicially determined.

The petition was presented to Judge Sherwood in chambers by a representative of Schmidt, Keesey, Stair and Kurtz, attorneys for the petitioners. It asks specifically that the court assume jurisdiction of the liquidation, that it pass upon and confirm the account filed, that it fix a time within which all claims against the corporation must be filed among the creditors, that it enter a decree dissolving the corporation.

The court ordered that the petitioners advertise that the account has been filed and that confirmation of the account will be applied for on August 31 at 10 a.m. and that unless exceptions are filed before that date the account may be then confirmed.

The court ordered that all creditors be required to file with the prothonotary proofs under oath of their respective claims on or before January 2, those failing to file to be barred from participating in the distribution of assets.

The petition reveals that in October, 1932, the company, being financially unable to continue business, with the consent of all large creditors entered into an agreement with the York Wall Paper Company to have that firm operate the plant at cost.

Such operation was continued until June, 1933, when operations were discontinued.

On June 7, 1933, a meeting of stockholders agreed that the business be wound up and that assets be converted into cash and distributed. On July 19, 1933, sale to the Western National Bank for $9,200 was authorized of all machinery, print rolls, raw material, inventory, finished goods and other items. On August 8, 1935, a meeting of stockholders consented to dissolution of the corporation.

News of the Industry

Lily-Tulip Corporation reports for twelve months ended June 30, 1936, net profit of $302,597 after depreciation, Federal income taxes, etc., equivalent to $1.60 a share on 189,539 no-par shares of common stock outstanding. No

(Continued on page 124)

Shear Cut—Clean Cut

LANGSTON SLITTERS AND ROLL WINDERS

SAMUEL M. LANGSTON COMPANY, CAMDEN, NEW JERSEY

Wisconsin Paper Machinery Plants More Active

Appleton Machine Co. Building Two Large Vortex Beaters for New Kraft Paper Mill at Crossett, Ark.—Northern Boiler & Structural Iron Works, Appleton, Busy With New Equipment and Extensive Paper Mill Repairs

[FROM OUR REGULAR CORRESPONDENT]

APPLETON, Wis., August 10, 1936.—A fairly brisk demand for new and improved equipment is keeping machine plants of the Fox River Valley busy. This is especially true of the Appleton Machine Company, Appleton, Wis., which is operating almost at its maximum capacity, according to R. M. Radsch, sales manager.

The company is finding its Appleton Vortex beater popular, and delivery is averaging at least one a month. Two large ones are now being built for the new kraft mill at Crossett, Ark. Quite a number have been produced for mills at the East and Middle West.

Invented by C. R. Seaborne, chief engineer of the Thilmany Pulp and Paper Company, Kaukauna, Wis., the Vortex beater produces pulp in about half the time of older types with faster feeding of stock, and occupying much less floor space. The beater was perfected six years ago, and manufacture was started in 1932. The first ones were installed in the Thilmany mill.

New equipment and extensive repairs for paper mills have stepped up production at the Northern Boiler and Structural Iron Works, Appleton, Wis. Work has been doubled on units made for assembly in machine plants, and the number of skilled employees is twice the number formerly employed.

Reorganization is contemplated by the Moloch Foundry and Machine Company, Kaukauna, Wis., makers of stokers and mill accessories. Stockholders will be asked to approve a plan which will reduce indebtedness and interest charges. Business has improved in the last six months to the point where a profit was earned, and the readjustment will enable the company to prosper, Ralph C. Rose, manager, declares.

Hummel & Downing Output Expands

Business of the Hummel & Downing Company, Milwaukee, is flourishing and the present production is approximately 100,000,000 paperboard boxes annually, according to John L. Barchard, president. The company is using about 120,000,000 pounds of waste paper stock annually, consuming all that Milwaukee and surrounding territory will produce. About 20,000,000 pounds of pulp are being imported from Canada and Sweden yearly to make up the mixture of waste pulp and virgin pulp for the boxes. Solid and corrugated fiber boxes are the chief output, filling a nationwide demand for cartons in almost every type of industry.

Pulpwood Destroyed by Fire

Forest fires have caused a loss of 1,800 cords of pulpwood to the Consolidated Water Power and Paper Company, Wisconsin Rapids, Wis., and a threat to 5,000 additional cords. The fire broke out on Isle Royale, in Lake Superior, where the company conducted logging operations last winter. The wood consumed had been cut but not hauled out of the woods, and was consumed when more than 3,000 acres of slash burned over. When an additional 5,000 cords ready to be rafted across Lake Superior was threatened, the company chartered a plane to deliver fire hose from Chicago and pumps from Milwaukee to save it. J. J. Plzak took charge of the operations, and enlisted a lumberjack crew to assist. More than 500 boys from Civilian Conservation Corps camps also were rushed to the island to fight the fires. A raft of 6,400 cords, ready to be convoyed across the lake was saved. A loss of approximately $35,000 was avoided by preventive measures. The company sold its remaining standing timber to the United States Government last year, when the island was set aside as a federal park.

News of the Industry

A new roadway is being constructed over the flumes of the Union Bag and Paper Corporation's mill at Kaukauna, Wis. The company was obliged to replace the road several times because of heavy truck traffic, but this time the City of Kaukauna is rebuilding it with municipal funds. Because of this work and low water, the mill was shut down for several days.

More than a million seedlings were distributed to farmers for planting on private lands during last year, according to reports of the Wisconsin Conservation Commission. A total of more than eight million trees also was planted on state forest lands. The plantings were mostly pine and spruce.

Freight rates for coal shipments from Great Lakes docks to cities of the Fox River Valley will remain at 70 cents a ton, under an order of the Wisconsin Public Service Commission suspending for an indefinite period the request of the railroads for a new tariff of 85 cents. The low rates were to have expired August 1. This means a considerable saving to paper mills using rail shipment for bituminous coal.

A volunteer fire department has been organized at the large plants of the Banta Publishing Company at Menasha, Wis. New equipment has been purchased, and men are being trained in their duties. The purpose is to check small fires quickly before the arrival of the city fire department.

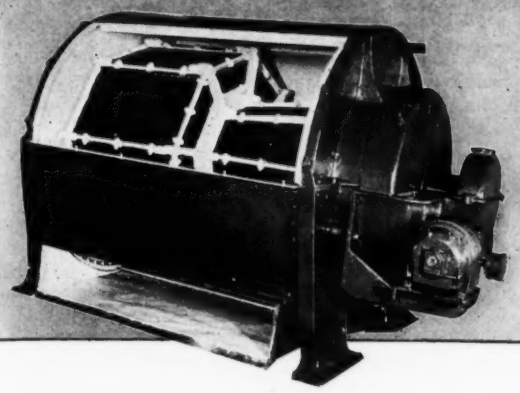
An estate valued at $1,831,091 was left by the late William Owen Goodman, lumberman and paper mill capitalist of Goodman, Wis. When the will was filed, the value of the estate was estimated at $1,200,000, but the rise in the stock market has increased the figure. Mr. Goodman died March 22 at the age of 87. Most of the estate was left to the widow.

Dr. Clarence J. West and Mrs. West have moved from Washington to 226 River Drive, Appleton, Wis. Dr. West, Chairman of the Committee on Abstracts and Bibliography of the Technical Association of the Pulp and Paper Industry, recently accepted an appointment as research associate at the Institute of Paper Chemistry. He will have charge of publications of the Institute.

Mr. and Mrs. M. A. Wertheimer, of Kaukauna, Wis., have sailed from New York on the S. S. *Southern Prince* for a vacation in South America. Mr. Wertheimer is with the Thilmany Pulp and Paper Company.

Ernst Mahler, executive vice-president of the Kimberly-Clark Corporation, Neenah, Wis., sailed recently aboard the S. S. *Queen Mary* for a month's stay in England. He was accompanied by Mrs. Mahler, daughter Polly and son, Peter.

Fifteen salesmen of the Pyramid Paper Company, Chi-



"IMPCO" Centrifugal KNOTTER

IMPORTANT EXCLUSIVE FEATURES

that are worthy of careful consideration if clean stock is desired:—

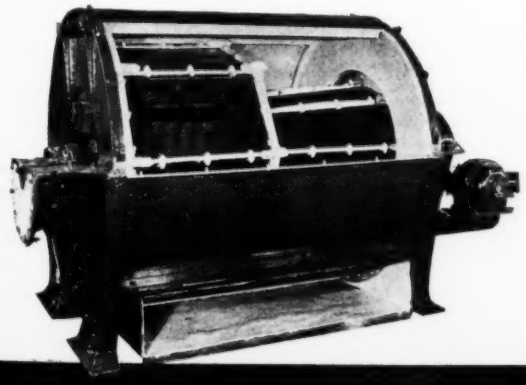
QUICK ELIMINATION OF REJECTS—
less than one second from time of entry.

NO MECHANICAL HANDLING—
rejects are at all times carried in water.

SHORT PLATES—
prevent rolling and disintegration of knots.

NO BAFFLES—
which break up rejects and separate bark from knots, producing black specks in pulp.

LOW PRESSURE SHOWERS—
thus the dirt produced by violent action of high pressure showers is eliminated.



Has but one moving part, the rotor, consisting of a large diameter Octagonal Drum with smaller secondary Octagonal Drum supported on a central shaft which is carried in Self-Aligning Anti-Friction Bearings. No packing glands are provided as the design obviates the necessity of their use. Low operating speed (25 RPM).

The Drive is an Integral Reduction unit with 2 HP Motor. Power requirements are exceptionally low, being less than 1 HP per unit. This unit can be supplied in Cast Iron, Steel, Bronze, Stainless Steel or Rubber Covered.

The stock enters through a stationary central chamber and is delivered to the plates over a horizontal lip of the inlet casting, which gives even distribution into each succeeding compartment of the rotating drum. Accepted stock readily passes through the plates, the rejections are retained by radial plates and elevated during the succeeding half-revolution of the drum and delivered into an inclined chamber filled with water. From this chamber, they flow into the second compartment of the drum, which is only 35" long, where additional washing by light showers takes place. Any remaining fibre removed in the second compartment is accepted.

Due to the fact that this Knotter is a complete unit, shipped assembled, of light weight, the installation cost is low. No concrete or other expensive foundation is necessary, any ordinary mill floor being ample to support it. No housing is necessary as the machine is a completely enclosed unit.

[Maximum capacity 125 tons, depending on stock. For further information, operating data, tests, etc., write or wire our engineering service department.]

IMPCO

IMPROVED PAPER MACHINERY CORPORATION

Nashua, New Hampshire

cago, made an inspection tour last week of paper mills at Appleton, Wis. They visited the Riverside Paper Corporation, the Telulah mill of the Fox River Paper Company, and the Interlake mill of the Consolidated Water Power and Paper Company. Their purpose was to gain more information on the processes of paper manufacture.

Fifty bank directors of Milwaukee and Chicago institutions with which he is associated were entertained by F. J. Sensenbrenner, president of the Kimberly-Clark Corporation, Neenah, Wis., at his estate on Lake Winnebago. They were guests for luncheon and dinner.

Robert DeLand, of the Valley Iron Works Company, Appleton, Wis., has been appointed alderman of the First ward. He fills the vacancy caused by the resignation of Henry W. Tuttrup, treasurer and assistant to the president of the Northern Paper Mills, Green Bay, Wis.

Gordon Wilson Brown, of Neenah, Wis., and Miss Elizabeth Jane Radford, of Oshkosh, Wis., were married last week at Oshkosh at the Radford home by the Rev. Joseph N. Barnett, rector of Trinity Episcopal Church. Mr. Brown is a son of D. K. Brown, first vice-president and general manager of the Neenah Paper Company, and is associated with the Weyerhaeuser Sales Company.

A wedding ring caught in gears caused the loss of two fingers of his left hand to Joseph Kryszak, an employee of the Wisconsin Tissue Mills, Menasha, Wis. His hand was drawn into the machinery.

Roy Schuler, 30 years old, was instantly killed in an accident last week at the Combined Locks Paper Company's mill at Combined Locks, Wis. He was carrying paper over a reel by hand when he became caught between a metal drum and the paper roll. His head and shoulders were drawn between two rolls before the machine could be stopped.

Ernest B. Morse, sales representative for the W. A. Fannon Trading Company, Appleton, Wis., dealers in paper mill equipment and supplies, died August 1 at his home at Appleton after an illness of several months. He was secretary of the former Hayton Pump and Blower Company up to the time the business was sold several years ago, and was well known in the paper industry. His widow survives him. Burial took place at Riverside Cemetery, Appleton.

Concerned About Paper From Japan

WASHINGTON, D. C., August 12, 1936.—Imports into England of transparent paper from Japan during the first quarter of this year reached a total of 255,696 pounds according to a report from Trade Commissioner O. S. Watson at London.

The report states that British makers of cellulose wrappings are becoming concerned about the inroads in the market by the Japanese product. According to information received application has already been made to the Import Duties Advisory Committee for protection for local manufacturers of transparent papers.

F. C. Huyck & Son Resume

[FROM OUR REGULAR CORRESPONDENT]

RENSSELAER, N. Y., August 8, 1936.—The mills of F. C. Huyck & Son will resume operations next week after the annual yearly shutdown for inventory and vacation period. The vacation week started Aug. 1 and several hundred persons are observing it. Announcement was made that the company had resumed the system of continuing the pay of employes during vacation time. This plan was abolished a few years ago and its restoration was welcomed by the workers. The company anticipates steady work for the remainder of the year.

National Paper Trade Association Takes Stand Against Unfair Price Discrimination

The National Paper Trade Association has issued to its members a pamphlet of "Questions and Answers on the Robinson-Patman Act" prepared by its counsel, J. K. Javits. As Mr. Javits is a recognized authority on such legislation, this pamphlet has received national attention and has been widely quoted and discussed in the newspapers. Hundreds of requests for copies have been received from other trade organizations, attorneys and important industrial concerns all over the country.

The National Paper Trade Association has taken a position of leadership in attempting to eliminate unfair price discrimination by merchants as well as manufacturers. The attention of the members has been emphatically called to their responsibilities under the Robinson-Patman Act. We quote from recent bulletins to members as follows:

"Every merchant must bear in mind that the provisions of the Bill apply not only to purchases he makes from manufacturers but to sales which he makes to customers as well, so that he becomes liable under the law if he knowingly accepts an unlawful discrimination from the manufacturers, and he is also liable if he gives unlawful discrimination to a customer.

"Merchants who have not published their own resale schedules should consider their position in the light of the Robinson-Patman anti-price discrimination legislation. In view of the seriousness with which this legislation is being considered, merchants must recognize that should a complaint of unlawful discrimination be registered against them under this new Act, their inability to show that their salesmen were provided with price books equally applicable to all customers might at the very outset prejudice any investigation."

Another bulletin recently issued to members of the association calls attention to apparent wide spread price discrimination on kraft paper quoting specific examples.

In the last issue of the *Wrapping Paper News Letter*, similar information is given out which has to do with toilet paper and towels.

It is because of the prevalence of such unfair price discrimination that the plan for preventing such discrimination by a conditional clause on orders, sponsored by the Middle States Wrapping Paper Association, is now being considered by the National Association as a means of implementing the Robinson-Patman Act.

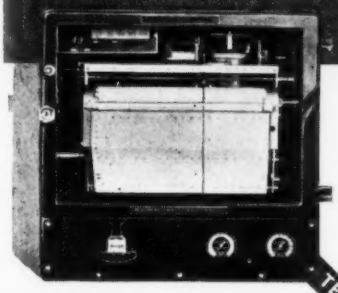
It is also understood that the National Paper Trade Association is considering the idea of reporting to members the lowest prevailing prices on certain major lines, such as kraft, bags, toilet paper, towels, etc. with the object of reducing unfair price discrimination to a minimum.

"Paper Jack" Dead

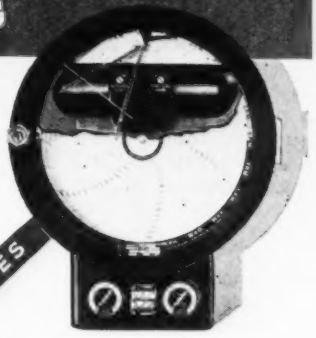
TORONTO, Ont., August 10, 1936—In a pamphlet published by the United Paper Mills, Toronto, under the caption of "Curious Facts About Paper," appears the following: "For twenty years a harmless derelict wandered the streets of the English cities dressed in a home made suit constructed of newspapers, handbills and posters tied to his body with strings. Although not dressed in the height of fashion he frequently changed his 'clothes' as a sanitary measure and for the amusement of the public. His tastes ran toward posters printed in brilliant red and yellow. None knew his real name but every one called him 'Paper Jack.' Recently a speeding motor car ran down 'Paper Jack' and newspapers throughout the British Isles treated his obituary notice with all the importance of a celebrity."

THE PROPER SOLUTION TO THESE CONTROL PROBLEMS IN PROCESSING

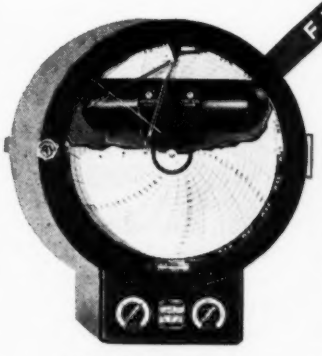
Leads to



AIR-o-LINE Potentiometer Controller combines in one instrument the measuring and recording precision of the potentiometer and the adaptability of the air operated controller with 1% to 150% throttling range and automatic reset. For temperatures—300° F. to plus 3400° F.



AIR-o-LINE pressure controllers with 1% to 150% throttling range and automatic reset are available for control of pressure within limits of 5" of water and 3000 pounds per square inch.



AIR-o-LINE flow controllers are furnished as either electric or mechanical type flow meters with 1% to 150% throttling range and automatic reset. For working pressures up to 2500 lbs.

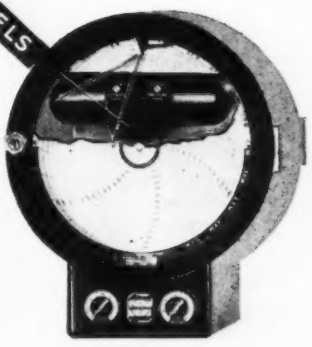
Brown AIR-o-LINE insures accurate measurement and precise control of temperatures, pressures, flows and liquid levels in process control.

Brown AIR-o-LINE provides a means for tuning into your specific process requirements simply and quickly, without dismantling the controller or interrupting its control operation.

Operators are encouraged to secure "best possible" not just "good enough" control results, so apt to be present where adjustments are complicated and time-consuming.

Brown AIR-o-LINE is set, with the same simplicity as dialing a radio. Once it is "tuned in" it becomes fully automatic. It not only controls the process within limits, but it "lines out" control at the exact desired control point, regardless of load or throughout changes, assuring you of balanced operation—and lower costs.

Brown AIR-o-LINE has everything you have wished for in air operated control—it "recognizes," "analyzes," and "corrects" for any departure from the exact control setting —without "cycling," "drifting," or "shifting" of the control point. Modernize your process control with this modern Air-Operated Controller. Write for Catalog No. 8900. The Brown Instrument Company, *a Division of Minneapolis-Honeywell Regulator Company*, 4510 Wayne Avenue, Philadelphia, Pa. Offices in the Principal Cities; Canadian Factory, 117 Peter St., Toronto, Canada. European Address: Minneapolis-Honeywell Co., Wijdesteeg 4, Amsterdam—C.



AIR-o-LINE liquid level controllers are furnished as either electric or mechanical type liquid level meters with 1% to 150% throttling range and automatic reset. For control of liquid levels from 20" of water to 100 feet of water.

BROWN AIR OPERATED CONTROLLERS

OUTSTANDING PERFORMANCE WITH SIMPLICITY

Joins Miami Valley Shippers' Ass'n

[FROM OUR REGULAR CORRESPONDENT]

DAYTON, Ohio, August 10, 1936—The Miami Valley Paper Shippers' Association, Inc., with headquarters in Middletown, has received two new members recently—the Aetna Paper Company of Dayton and the Miamisburg Paper Company of Miamisburg, 10 miles south of Dayton.

The Miamisburg firm began including shipments in pool cars about the middle of May. The company makes a fine line of bristol. Its affiliate, the American Envelope Company, West Carrollton, seven miles south of Dayton, can also include envelopes in the pool shipments to the Pacific Coast due to the set-up on the Association's Coast service.

Since the first of June the Association has been including shipments of the Aetna Paper Company, whose complete line of rag content board starts with Old Aetna (100 per cent) down to Correct Bond, (25 per cent). Other well-known bonds in the line are Ovation, Daytonia, Cosmopolitan and Discovery. The Aetna Company also makes Supply Index (sulphite), No. 1 Sulphite and Crusader Cover.

The association has been doing splendid work. An all-time pool record was established in January, the shipping totals rivaling anything that had gone before, and in fact, exceeding it. The number of pool cars forwarded to then was 137, which was 34 per cent more cars than were used in January a year ago. The previous high, 126 cars, was set in August of last year, which belies the claim made by some that severe weather conditions controlled the shipments. The two records were established exactly under opposite climatic conditions. August of last year retains, however, the record for number of destinations to which pool shipments were consigned. This was 43, or three more than the number of destinations to which shipments were moved in January.

The pool car and truck tonnage from the Miami Valley in January amounted to 9,852,520 pounds, a gain of 16.1 per cent over the January, 1933, total. Each month since then has shown a satisfactory gain. When the records are compared with 1935, much interest is manifested as 1935 recorded record-smashing monthly gains, the total pool loadings amounting to 77.7 per cent more for the year than in 1934. The July and August issues of the Miami Valley Carloader will be omitted this year, the June issue being the last until September. G. R. Braun, secretary of the association, returned today from his vacation. C. J. Schlayer has been in charge during his absence.

Pulpwood Prices Soft

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, Ont., August 10, 1936—Maritime & Gaspe Pulpwood, Ltd., Cambellton, N. B., say recent indications are that although the demand for pulpwood is fairly steady, some of the mills have already contracted for their supply next year at lower prices than they paid this year. They state that the only possibility of a substantial increase in the price of wood is "bona-fides" in the price of paper of, at least, five dollars per ton and that it would be advisable for producers of wood to make arrangements for its disposal at a fixed price before commencing their operations next fall and winter.

Commenting on this statement of the company a leading authority says that the present price of pulpwood is too low for the value and amount of work involved and that brokerage firms would pay more if they were obliged to do so. What is needed, apparently, is some marketing cooperation on the part of the smaller producers.

Outlook for Great Lakes Paper

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, Ont., August 10, 1936—The Great Lakes Paper Company, Fort William, Ont., which was recently taken out of the hands of receivership, has two machines with a rated capacity of 100,000 tons annually and is one of the lowest cost inland mills on the continent. The company lately went through a capital reorganization with the dual result of reducing fixed charges and obtaining long term contracts which give virtual capacity production of newsprint. With the recent rise in the price of newsprint, it is stated that the Great Lakes Paper Company should be able to make payments on its new bonds within twelve months, as indicated by the current price of about sixty dollars for one hundred dollars of old bonds. The price places considerable value on the new shares that are to be issued to bondholders. The prospects for dividends depend entirely upon the figure for newsprint under the present arrangement with the Government. As long as the company pays its bond interest the new shares will hold long-run possibilities of dividends.

Sorg Paper Co. In The Bag Line

[FROM OUR REGULAR CORRESPONDENT]

DAYTON, Ohio, August 10, 1936—The Sorg Paper Company, Middletown, which recently took over the Superior Bag and Paper Corporation and the Lawrence Bag Company, both of Middletown, reports substantial progress in that line.

Of special interest is the announcement, made recently, that Ernie E. Brown is to be general manager of Sorg's consolidated bag division, now the Superior-Lawrence Bag Division of the Sorg Paper Company.

The view taken in the Miami Valley is that the step taken by the Sorg Paper Company will better the bag situation and congratulations are being received on the improvement in the industry.

Mr. Brown is widely-known in the paper trade and his friends assert he is certain to give a good account of himself in his new position.

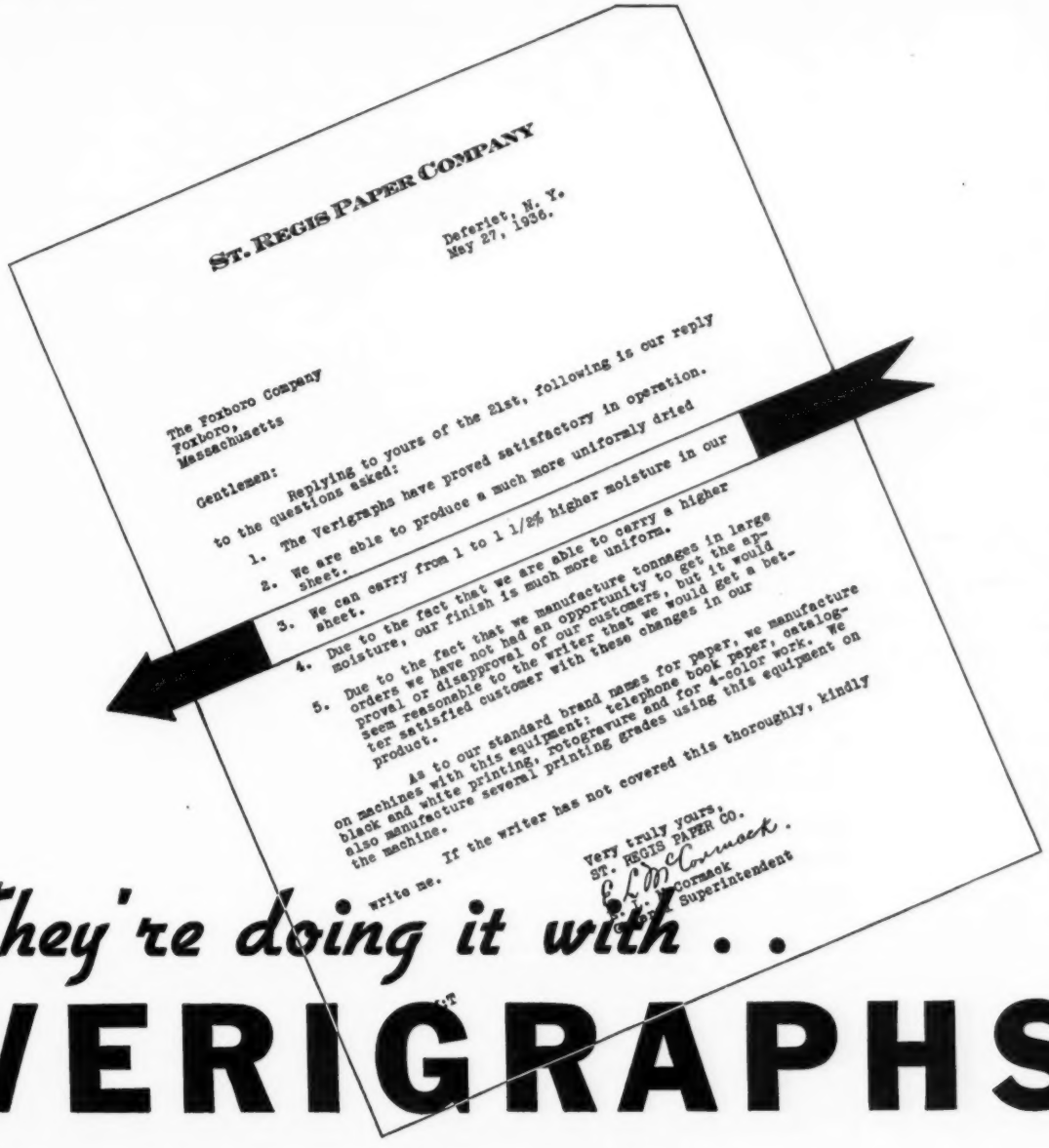
Schmidt & Ault to Build Warehouse

YORK, Pa., August 11, 1936—The Schmidt & Ault Paper Company have started construction work on a new waste paper storage warehouse. The structure will be 90 by 200 feet and 40 feet high. It will be built of steel and the outside covered with corrugated iron with a wooden roof thoroughly sprinkled. The structure will contain an overhead traveling crane to facilitate storage. It is calculated to hold 3,000 tons of waste paper. When the building is completed, it will be a thoroughly modern structure capable of handling bales of paper in the most economical way.

France Restricts Ground Wood Imports

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., August 5, 1936.—Effective May 4, 1936 mechanical pulp for the manufacture of paper was made subject to import quota restriction in France according to a report to the Department of Commerce from Assistant Trade Commissioner E. A. Masuret at Paris. Individual import licenses must be obtained by French importers in advance. Chemical pulp has been under import quota restriction since December, 1933.



ST. REGIS PAPER COMPANY

Deferiet, N. Y.
May 27, 1936.

The Foxboro Company
Foxboro,
Massachusetts

Gentlemen:

Replying to yours of the 21st, following is our reply to the questions asked:

1. The Verigraphs have proved satisfactory in operation.
2. We are able to produce a much more uniformly dried sheet.
3. We can carry from 1 to 1 1/2% higher moisture in our sheet.
4. Due to the fact that we are able to carry a higher moisture, our finish is much more uniform.
5. Due to the fact that we manufacture tonnages in large orders we have not had an opportunity to get the approval or disapproval of our customers, but it would seem reasonable to the writer that we would get a better satisfied customer with these changes in our product.

As to our standard brand names for paper, we manufacture on machines with this equipment; telephone book paper, catalog- black and white printing, rotogravure and for 4-color work. We also manufacture several printing grades using this equipment on the machine.

If the writer has not covered this thoroughly, kindly write me.

Very truly yours,
ST. REGIS PAPER CO.
E. L. McCormack
E. L. McCormack
Superintendent

They're doing it with . .

VERIGRAPHS

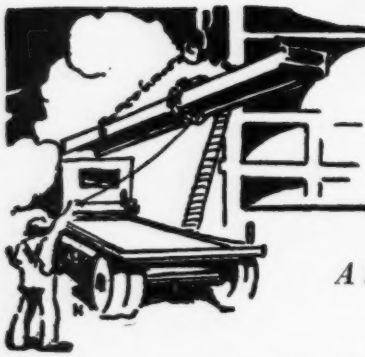
What would it mean to you to carry 1 to 1½% more moisture in your sheet; to produce a more uniformly dried sheet; to get more uniform finishes? These are the results obtained by St. Regis with Verigraph Moisture Controllers—and they explain why St. Regis recently added three Verigraphs after using one for over a year.

Have you investigated the Verigraph? It enables you to produce paper of any desired moisture content—a fact proved over and over again in the 45 different paper mills where more than 75 Verigraphs are in actual use today.

THE FOXBORO COMPANY
114 Neponset Avenue, Foxboro, Mass.

FOXBORO
REG. U. S. PAT. OFF.

COMPLETE PULP AND PAPER MILL INSTRUMENTATION



CONSTRUCTION NEWS

A Summary of Vital Facts Regarding Construction, Finances and Operation of Paper Mills

Construction News

Buffalo, N. Y.—The Buffalo Envelope Company, 270 Michigan avenue, manufacturer of commercial envelopes and kindred paper products, has taken out a permit for new addition to paper converting plant, on adjoining site at Michigan avenue and Carroll street. It will be three-story, estimated to cost over $45,000, with equipment. General contract has been let to the Metzger Construction Company, 249 Carlton street, Buffalo, and superstructure will be placed under way at once. Laurence G. Reineman is president.

Trenton, N. J.—The Trenton Container Company, Inc., recently organized under State laws, has leased space in local building at 1 Johnston avenue, totaling about 15,000 square feet of floor space, and will occupy at once for new plant for the manufacture of corrugated boxes and containers. Equipment will be provided for large capacity, with employment of about 25 persons for initial operations. Officials of the new company include Roy W. Williams, president, and E. E. Gaus, secretary and treasurer, both being formerly connected with the Container Corporation of America, Inc., at its Philadelphia, Pa., branch plant.

Los Angeles, Cal.—The California-Oregon Paper Mills, Inc., manufacturer of wrapping papers, tissue stocks, etc., has taken out a permit for one-story addition to plant at 2001 East 57th street, Vernon district, and will proceed with superstructure at once. New unit is reported to cost over $25,000, including equipment. General contract has been let to the Austin Company of California, 777 East Washington street, Los Angeles.

Long Island City, N. Y.—Bernard H. Silfen & Son, 200 Franklin street, Brooklyn, N. Y., paper products, have leased one-story building at 1139-41 Fiftieth avenue, Long Island City, and will occupy for new storage and distributing building. Company will take immediate possession.

Hinsdale, N. H.—The Hinsdale Paper Manufacturing Company, manufacturer of tissue and other paper stocks, has work nearing completion on new three-story mill, 80 x 200 feet, on which construction was started a number of weeks ago, and will occupy for operations at early date. It will replace a unit destroyed by fire. Miscellaneous completion contracts are being let, including electrical installation award to the Starr Electric Company, Inc., 23 Besse place, Springfield, Mass. The J. W. Bishop Company, 109 Foster street, Worcester, Mass., is general contractor. New mill will represent a reported investment of about $125,000, including equipment. McClintock & Craig, 458 Bridge street, Springfield, are consulting engineers. Louis N. Stearns is treasurer and general manager.

Chicago, Ill.—The Crown Zellerbach Corporation, 343 Sansome street, San Francisco, Cal., manufacturer of paper goods, has concluded arrangements for purchase of property and business of the Midland Paper Company, 652 West Randolph street, Chicago, and will take immediate possession. Midland company will be operated in future as a unit of the purchasing company. It is said that operations will be continued without change at present location.

Hermosa, Ill.—The United States Gypsum Company, 300 West Adams street, Chicago, Ill., manufacturer of wallboard products, etc., has awarded general contract to the Campbell, Lowrie & Lautermilch Corporation, 400 West Madison street, Chicago, for new one-story addition to factory branch, storage and distributing plant at 1719 North Kostner street, Hermosa, recently referred to in these columns. Superstructure will be placed under way at early date. Structure is reported to cost close to $35,000, including equipment.

Shelton, Wash.—The Rainier Pulp and Paper Company has plan maturing for new addition to mill, to be used primarily as a break-down and chipping plant, and will place general contract for erection at early date. An award for this work, previously referred to in these columns as being let to the R. Kimbell Company, Shelton, covered the driving of about 800 piles for the foundation for the new unit only, while J. H. Coyne, Port Townsend, Wash., has the contract for the rebuilding of a 16-inch pipe line for liquor discharge, connecting with pumping station on First street. Work on both of these contracts has been started. Entire project is reported to cost close to $350,000, including equipment.

Los Angeles, Cal.—The Consolidated Paper Manufacturing Company, recently organized with capital of $200,000, plans operation of a local mill for the manufacture of a line of commercial paper goods. It is proposed to carry out production at early date. New company is represented by Feinfeld & Feinfeld, 215 West Fifth street, Los Angeles, attorneys. The incorporators include F. M. Slayton and L. S. Young, Los Angeles.

Albany, N. Y.—The A.P.W. Paper Company, 1273 Broadway, manufacturer of tissue papers, etc., has authorized a note issue to total $130,000, proceeds to be used for the consolidation of the two mills of the company at Albany and North Albany, respectively, previously referred to in these columns. It is understood that the program will be completed at early date. Johnson & Wierk, Grand Central Terminal Building, New York, N. Y., are consulting engineers.

Buffalo, N. Y.—The duPont Cellophane Company, Inc., River road, manufacturer of transparent wrapping materials, has approved plans for construction of group of five new one-story additions to local mill, for which superstructures are scheduled to begin at once. Erection will be carried out by company forces, under supervision of W. F. Lawless, construction engineer. The entire expansion is reported to cost over $100,000, including equip-

FREE FLOWING

Bewoid needs no preheating. Just pour it from the drum into your Beater.

Bewoid is economical. Rosin consumption has been cut 25%; Alum 50% and more.

Recent run on high grade board showed 30% better sizing, reduced foam with pH of 7.0 maintained throughout.

Sizing at a higher pH with Bewoid will produce finer quality paper.

You can choose between making Bewoid in your own mill or purchasing from us in any quantity in drums.

BULKLEY DUNTON & CO.

295 MADISON AVE., NEW YORK, N. Y.

Selling Agents for

AMERICAN BEWOID COMPANY

BEWOID

ROSIN SIZE

ment, and will provide for considerable increased production at plant, as well as storage and distribution facilities.

Rochester, N. Y.—The Haloid Company, 6 Haloid street, manufacturer of photographic and other processed paper stocks, will take bids on general contract within the next two to three weeks for proposed new addition to plant, lately noted in these columns. Plans are being completed. New unit will be two-story and basement, reported to cost in excess of $50,000, with equipment. S. Firestone, 59 South avenue, Rochester, is architect and engineer.

Detroit, Mich.—The Detroit Paper Products Corporation, 5800 Domine street, manufacturer of corrugated paper boxes and containers, sheets and pads, etc., is running on a full capacity schedule in all departments and will continue on this basis throughout the summer period, with orders on hand to insure such production schedule well into the fall season. Similar capacity is operative in the recently established plastics division, used for manufacture of refrigerator insulation and allied specialties. Large working force is being employed. Seymour H. Franklin is president.

Tacoma, Wash.—St. Regis Kraft Company, Tacoma, has awarded general contract to Howard S. Wright & Co., Inc., 2210 Second avenue, Seattle, Wash., for proposed extensions and improvements in local sulphite pulp mill on Middle Waterway, North End district. A number of new steel frame structures will be built to provide for large increase in former capacity of about 55,000 tons per annum. Present units will be remodeled and modernized, including conversion for bleached pulp production. A large wharf will be built, included in contract to company noted. The plant has been idle for about five years and when ready for service will give employment to about 250 men. Entire project is estimated to cost close to $1,000,000 including equipment. George Schuchart will be superintendent of construction at plant site. H. S. Ferguson & Co., 200 Fifth avenue, New York, N. Y., are consulting engineers. Company is a subsidiary of the St. Regis Paper Company, 230 Park avenue, New York. W. W. Griffith is general manager at plant.

New Companies

Cleveland, Ohio—The Clover Paper and Twine Company has been incorporated with capital of 250 shares of stock, no par value, to deal in commercial paper products. The incorporators include H. A. Thomas and Willis G. Chandler, 116 St. Clair avenue, N. W., Cleveland. Last noted is company representative.

Milwaukee, Wis.—The Tomahawk Pulp and Paper Realization Syndicate, Inc., has been formed under State laws by interests identified with the property of the Tomahawk Pulp and Paper Company, Tomahawk, Wis., now idle and in receivership, to handle the real estate and other assets of the organization. Company is represented by Morris Stern, 808 North Third street, Milwaukee, attorney.

Eagle Lodge Plans Membership Drive

[FROM OUR REGULAR CORRESPONDENT]

HOLYOKE, Mass., August 11, 1936—Eagle Lodge Papermakers, the local papermakers' union, is planning a big drive to increase the membership of the body, in conjunction with plans of the international body which is urging a systematic drive for this purpose all over the country and Canada. The local union has been increasing its membership gradually for the past two years but the leaders feel it needs further additions.

Indianapolis Demand Rather Slow

[FROM OUR REGULAR CORRESPONDENT]

INDIANAPOLIS, Ind., August 10, 1936.—In spite of somewhat cooler weather, demand for paper in this territory has not rebounded as it should, according to local executives. Some call is seen in the fine paper field, but such items as books, ledgers and covers are not moving as they had been expected to move. Of course, seasonal influences are against them, but the trade had expected some advance demand against the fall business volume before this. However, local wholesalers are not discouraged. There is every prospect for a good fall business. Feelers put out among the local advertising men and printers show there is a world of business in prospect, principally direct mail literature.

Among other business that has sunk during the summer and has failed to revive to any extent, is the envelope business. Reports from two large envelope factories here show business at a low ebb. But, again, there is no pessimism. This is a poor time of the year for the envelope business at best. It is possible that this summer will show a lesser percentage of decline than the last five and that, at least, is something.

On the brighter side is the summer specialty business. This year, due perhaps to more money in circulation and to extremely hot weather, has been a banner year and the trade is looking for a continued rushing business until after Labor Day. Stocks are well balanced, but are being kept as low as is consistent with the demand.

Another bright spot is the container field. Box factories and other container makers in this section have no complaint on business. In fact most of them are working almost to capacity in spite of hot weather. It is reported that out-state demand with some of the larger plants is picking up rapidly and the fall season has started earlier than usual.

Paper stock men are none too delighted with mill demand. It is reported that a lot of quibbling is being done concerning paying prices for stock. Most local warehouses have plenty to sell.

Newsprint has held steady during the summer.

Mead Corp. Makes Good Report

[FROM OUR REGULAR CORRESPONDENT]

DAYTON, Ohio, August 10, 1936—A substantial increase in earnings of the Mead Corporation is shown in a report for the first six months of 1936.

The company earned $404,442 in the period, contrasted with a profit of $261,128 in the first half of 1935.

The net sales rose from $6,462,681 last year, during a corresponding period, to $7,886,735, the report discloses.

After allowance for current dividends on preferred stock, the half-year income is equivalent to 53 cents a share on 588,552 common shares, against 29 cents a share on 587,895 common shares in the first half of the preceding year.

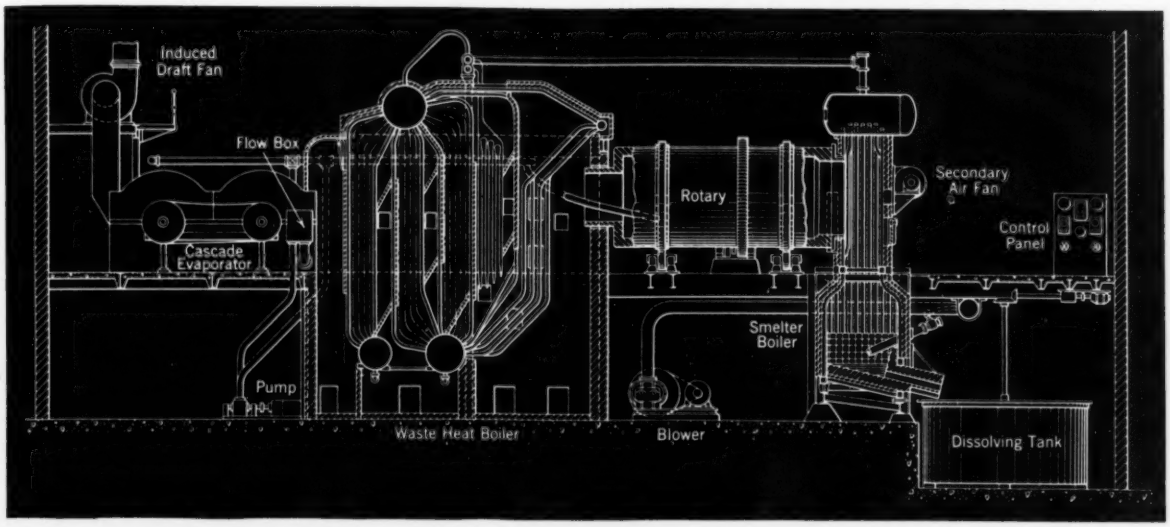
George V. S. Carroll Dead

[FROM OUR REGULAR CORRESPONDENT]

FRAMINGHAM, Mass., Aug. 10, 1936—George V. S. Carroll, a member of the board of directors of the Dennison Manufacturing Company, died last week at his home on Edgell Road after a short sickness. He was born in Brooklyn, N. Y., 56 years ago and came here in 1921. He was with the Dennison Manufacturing Company for nearly 35 years.

Surviving are his widow, a son, Donald V. and a daughter, Margaret.

THE CE MURRAY-WAERN SYSTEM
for Chemical and Waste Heat Recovery



9 More Units Ordered
in the period Jan.-July, 1936

The CE Murray-Waern System has demonstrated exceptional results with respect to

Steam Production
Chemical Recovery
Chemical Reduction
Dependability
Availability
Cleanliness
Control
Safety
Economy

●

Suitable for black liquors from either Northern or Southern woods.

This increasing preference for the CE Murray-Waern System is the direct result of its record of successful performance under all conditions. And this record in turn is due to the utilization of sound operating principles long established in practice and applied through a system of improved design and construction. There is nothing experimental about the CE Murray-Waern System. There can be no uncertainty about the results. The nine units recently ordered were purchased following thorough investigation of the comparative performance of CE Murray-Waern installations and competitive units.

If you are interested in the economies and other advantages obtainable either through replacement of old type smelter furnaces or the installation of a complete chemical and waste heat recovery system, ask us for information on the results you will get with CE Murray-Waern equipment.

COMBUSTION ENGINEERING COMPANY, INC.

Associates: D. J. Murray Manufacturing Company, Wausau, Wis.
200 Madison Ave., New York, N. Y.
Canadian Associates; Combustion Engineering Corporation, Ltd., Montreal

A-294 R

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Ronald G. Macdonald
Editor Technical Section

Herbert J. Laughton
Associate Editor

Thomas J. Burke, C. A.
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THE GOODYEAR CASE AS A PREVIEW OF THE ROBINSON-PATMAN ACT

Among people whose business it is to be informed on such topics, it is coming to be believed that the Robinson-Patman law to eliminate unfair price discrimination which was passed by the last Congress and which is now in operation, will transcend in importance any piece of legislation enacted since the Sherman Anti-Trust law was adopted in 1890. Everywhere in spite of careful studies and analyses, it is plainly causing great perplexity as to its true scope and power.

Recognizing the significance of the Federal Trade Commission's recent decision in the Goodyear case as a possible preview of many of the problems which business will have to face under the Robinson-Patman Act, Dun & Bradstreet, Inc., have prepared a comprehensive analysis of that Decision in its relation to the Act.

The study is a consolidation of three articles by Edwin B. George, Staff Economist of the Dun & Bradstreet Research and Statistical Division. Mr. George reviews the events leading up to the decision by which the Federal Trade Commission ordered the Goodyear Tire and Rubber Company to cease and desist from according the wide price differentials to Sears, Roebuck & Co. that the latter had enjoyed since 1926 under a series of long term contracts.

A foreword by Dr. Willard L. Thorp, Director of Economic Research, Dun & Bradstreet, Inc., compares the old and new Clayton Acts and discusses the relation of the Goodyear case to the Robinson-Patman Act.

The case itself required 2 years to hear and 25,000 pages to record. Running through that long record the economist identifies a number of "business control" issues common to both the old Clayton Act and the Robinson-Patman Act. Among them are the problems of determining product and customer costs in detail rarely required or previously developed in ordinary business accounting. To these are joined the legal puzzles of determining when competition among either manufacturers or retailers is curtailed, when such curtailment is "substantial"; of deferring judgments and penalties until the results of a contract can be ascertained, perhaps long after it is entered into, instead of at the time of signing. In the wake of both operating and legal questions, trail such economic problems as the "little man's rights" in his highly advertised battle to survive, the definition of monopolies, the benefits or injuries arising out of arbitrary Governmental action, and the possible ultimate effects on business of the philosophy inherent in this Decision and in the new Act.

The personal bearing of these issues on individual manufacturers and retailers is stressed by Mr. George in the suggestion that "Thousands of manufacturers and distributors may be startled to learn that profound legal battles were waged over the legitimacy of certain odds and ends of practices that to them were commonplace and an unquestioned part of their whole business tradition."

The Goodyear case bristles with accounting technicalities that by implication seem to call upon some types of business to revise their accounting procedures in minute detail.

How should advertising and selling expenses be allocated to customers buying in different quantities? What shares of administrative expense should be charged to the rank and file of customers and to mass distributors respectively? How will business adjust itself to the new legal doctrine that there is no value to a manufacturer in quantity business, in the utilization of excess capacity, in its absorption of overhead, in its insurance against incessantly fluctuating prices and profits familiar to the general market, other than those reflected by the arbitrary rules of cost accounting.

Apart from the possibly heavy hand that the amended Clayton Act may lay on individual manufacturers, wholesalers and retailers, what of its general economic effects? Will existing channels of distribution shift under the load? Will present price structures be materially modified? Will consumers, as well as business men, be confronted with a new marketing world to which they must make their patient and difficult adjustments? Such possibilities are examined in the course of the analysis.

Almost any manufacturer selling to two sizes of competing customers is believed by Mr. George to have been drawn within the shadow of these problems by the legal requirements of the Robinson-Patman Act and the paralleling administrative formulae evolved in the Goodyear case. He remarks as to this point, "It is apparent that all manufacturers perform at least one of the functions at issue in this case. Worries over proper allocation of overhead to different departments, and of selling and advertising expense to different markets, are not new. In this case they became a matter of public concern, and under the amended Act are certain to do so again. If a manufacturer sells the same branded product to two sizes of customers, his methods of cost allocation may invite inquiry. If goods are packed for a customer under the latter's own brand, the application of the case is direct."

Illustrative of the long reach of this law into prosaic

matters that had never occurred to most manufacturers and retailers as having any importance for public issues, the author adds—"The operation by a manufacturer of his own retail outlets may not be pertinent to many, but financial relations between suppliers and customers are common. Where the latter exist, is some one being discriminated against? And in almost any case of unequal price treatment promised on differing quantities, isn't there a conviction of value received in which prim bookkeeping has no part at all? There are doubtless other considerations commonly underlying price discrimination in American business that the Goodyear-Sears transaction did not involve. The principle and method of exact measurement implicit in this case, however, may involve them in the next, always provided that the courts concur with the Commission's view of the old Clayton Act and uphold the validity of that Act as recently amended."

Cotton Rag Conference Committee Meeting

The joint conference committee made up of a committee from the Writing Paper Manufacturers Association and the Associated Rag Industries, which is the Cotton Rag Division of the National Association of Waste Material Dealers, Inc., held one of its periodic meetings at the Waldorf-Astoria, New York, on Wednesday, August 5.

Practically all members of the two committees were in attendance and discussions were continued covering problems in which both the paper manufacturers and the cotton rag dealers are vitally interested. It was the unanimous opinion of the two committees that the cellulose acetate problem was well in hand and that the educational work and the publicity which the committees had inaugurated in April had proved very helpful in clearing up that particular situation.

The other important reason for establishing these joint conference committees was to bring home to the cotton rag trade as well as to consumers of cotton rags the danger which exists that other fibers may seriously curtail the consumption of cotton rags, particularly if such rags continue to advance at a rate out of proportion to the advance of raw cotton which has been the case recently.

The committees which met on the 5th canvassed this entire situation, having in mind not only the immediate situation but conditions which may exist for some time in the future. Both dealers and manufacturers were agreed that the subject is equally important to both and that through mutual cooperation and better understanding of the situation, markets for cotton rags in the future may not only be maintained but possibly enlarged.

The conferences which the two committees have already held will be continued from time to time and the cooperation of the entire cotton rag trade will be sought in the hope that there may be developed a better realization on the part of the dealers of the danger which faces the trade in the loss to other fibers of a substantial part of the present cotton rag tonnage consumed by paper manufacturers.

Schroon River Makes Dam Improvements

[FROM OUR REGULAR CORRESPONDENT]

WARRENSBURG, N. Y., August 10, 1936.—Improvements to the dam of the Schroon River Pulp and Paper Company, are nearly completed by employees. The dam was severely damaged by flood waters last spring and employees of the pulp mill were given the task of placing it in good condition.

Production Ratio Report

These statistics are based upon paper production reports to the American Paper and Pulp Association.

COMPARATIVE MONTHLY SUMMARIES

Month	1936	1935	1934
January	76.1%	65.8%	.....
February	77.9%	70.0%	.....
March	76.0%	70.5%	.....
April	82.3%	70.0%	.....
May	81.6%	69.4%	.....
June	80.7%	72.3%	.....
July (b)	.....	67.8%	.....
August	.....	70.9%	.....
September (c)	.....	75.0%	59.4%
October	.....	75.6%	64.7%
November	.....	75.3%	61.7%
December (a)	.....	74.3%	62.1%
Year	.....	71.2%	.....

COMPARATIVE WEEKLY SUMMARIES

CURRENT WEEKS, 1936		CORRESPONDING WEEKS, 1935	
*July 4 (b)	82.8%	July 6 (b)	58.5%
*July 11	75.6%	July 13	69.1%
*July 18	80.2%	July 20	71.8%
*July 25	80.6%	July 27	70.3%
*August 1	77.7%	August 3	70.7%

The following statistics show the number of mills reporting by ratio groups:

	Number of Mills Reporting, Current Weeks				
Ratio Limits	July 4, 1936	July 11, 1936	July 18, 1936	July 25, 1936	Aug. 1, 1936
0% to 50%	91	99	88	81	62
51% to 100%	239	232	236	239	164
Total Mills Reporting	330	331	324	320	226

* Subject to revision until all reports are received.
These data exclude (a)—Christmas Day, (b)—Fourth of July, (c)—Labor Day.

PAPERBOARD OPERATING RATIOS

According to reports from the National Paperboard Association, per cents of operation, based on "Inch-Hours," were as follows:

1934	1935	1935	1936
Sept. 62%	Jan. 61%	July 59%	Jan. 61%
Oct. 63%	Feb. 67%	Aug. 65%	Feb. 67%
Nov. 56%	March ... 67%	Sept. 69%	March ... 68%
Dec. (a).. 53%	April 61%	Oct. 76%	April 70%
	May 61%	Nov. 70%	May 68%
	June 65%	Dec. 60%	June 68%

Week ending July 4, 1936—65%
Week ending July 11, 1936—53%
Week ending July 18, 1936—71%
Week ending July 25, 1936—70%
Week ending August 1, 1936—74%

Brown Co. Preferred Committee Named

[FROM OUR REGULAR CORRESPONDENT]

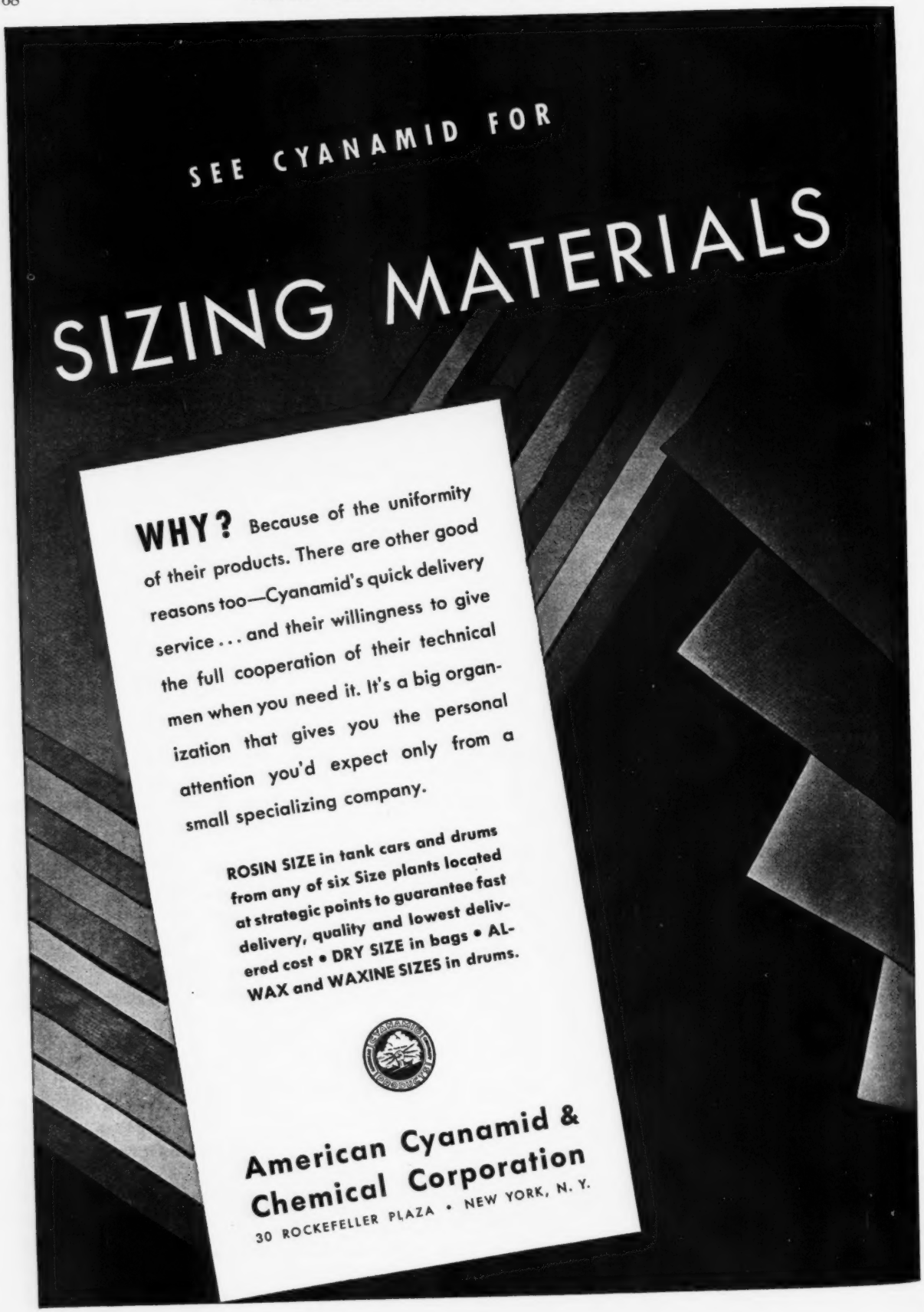
BOSTON, Mass., August 10, 1936—A protective committee representing preferred stockholders of Brown Company, Berlin, N. H., has been organized and given leave to intervene in the 77-B proceedings for reorganization in the United States district court for the district of Maine by order of Judge John A. Peters, dated Aug. 3.

The committee is made up of Edward H. Osgood of Boston, chairman; Frank P. Carpenter of Manchester, N. H.; H. Nelson McDougall of Portland, Me.; Sherman N. Shumway of Bangor, Me.; and Laurence F. Whittemore of Pembroke, N. H. John R. McLane of Manchester, N. H., is secretary of the committee, and the firm of McLane, Davis & Carleton, Manchester, N. H., are attorneys.

There are 100,000 shares of preferred stock of $100 par value issued and outstanding, held by over 3,000 stockholders.

Acoustical Board from Cornstalks

The Engineering Experiment Station Laboratory, Iowa State College, Ames, Iowa, has developed a process for the production of acoustical board products using cornstalks as raw material. Tests on the new board show high qualities in eliminating echoes by absorbing the sound rather than allowing it to reflect.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Section of the
Technical Association of the Pulp and Paper Industry
Edited by Ronald G. Macdonald, Secretary

Twenty-Four Years of Canadian News Print*

By Royal S. Kellogg[1]

There are two convenient reasons for beginning this brief historical review of the Canadian newsprint paper industry with the year 1913:

1st—Only from that date are complete yearly statistics available.

2nd—The removal of the United States duty on newsprint paper in 1913 started Canadian newsprint to going places which it has done increasingly since that time.

Production

Canada manufactured 350,000 tons of newsprint paper in 1913. In 1936 the output will be nearly nine times the 1913 volume.

An annual production of a million tons was reached and passed in nine years from 1913. The peak output of United States newsprint—1,680,000 tons in 1926—was exceeded by 200,000 tons by Canada in the same year and from that time forward Canada has been the greatest single producer of newsprint paper in the world. The year 1929 brought a temporary high of 2,729,000 tons. The bottom of the great depression in 1932 reduced Canadian newsprint tonnage to 1,914,000, but 1935 was slightly ahead of 1929 and a new high record of 3,000,000 tons or more is in the making in 1936. This year Canada will apparently produce nearly 40 per cent of an estimated world newsprint output of around 8,000,000 tons—and that is going some. Yearly details which need not be repeated are shown in Table I.

Exports

The most outstanding fact about the Canadian newsprint paper industry is its dependence for existence upon expanding export markets. In this respect it closely parallels Norway, Sweden and particularly, Finland.

In the year 1913, 73 per cent of the Canadian newsprint was exported. Out of a total of 257,000 tons shipped out of the Dominion 218,000 tons went to the United States and 39,000 tons overseas. This was the real start of participation of the Canadian newsprint industry in the great United States market and in a relatively short time Canada came to the domination of that market. In 1914 and 1915 exports of Canadian newsprint amounted to 86 per cent of production. They reached 90 per cent in 1923 and have never been less than that proportion since then, rising to 94 per cent in 1935 and an even greater proportion in 1936. Finland exported the same percentage of her newsprint output in 1935 as did Canada.

Exports of Canadian newsprint to the United States passed the million ton mark in 1923, and apparently are now permanently established on a basis of more than 2,000,000 tons. Overseas exports got into the 100,000 ton class in 1926 and apparently will be about six times as much or around 600,000 tons in 1936. Overseas markets for Canadian newsprint at the present time are chiefly in Australasia, Japan, Africa, South America and the United Kingdom. The detailed list of countries to which Canadian newsprint in some quantity finds its way is a long one, but in so doing it has to meet intense competition with newsprint manufactured in Norway, Sweden, Finland and Germany. Newsprint paper is one of the best examples we have of world competition in an essential commodity. (Table II).

The United States Market

Everyone who makes or uses newsprint paper has some idea of the importance of the United States market, but many do not realize the extent to which it is now filled by the output of Canadian mills. Table III shows the newsprint paper available for consumption in the United States yearly since 1913. (Actual consumption in some years was somewhat different due to changes in publishers' stocks.) We find Canada supplying 15 per cent of the United States market of 1,482,000 tons in 1913 and 63 per cent of the 3,272,000 tons similarly available in 1935. It took only 14 years for Canada's 15 per cent participation in the United States newsprint market in 1913 to grow to 51 per cent of a greatly increased supply in 1927, while according to present indications Canadian newsprint mills will furnish 65 per cent of the 3½ million tons of newsprint paper being used in the United States in 1936. Allowing for Canadian wood and pulp used in the manufacture of newsprint in the United States, it seems conservative to say that Canadian forests now furnish over 70 per cent of the newsprint paper used in the United States. (Table III)

There is probably no other case on record where the product of one country has so fully entered into the markets of another country so quickly as has been true of newsprint coming from Canada into the United States. There is not time here to touch upon the great interlocking of interests and investments between the two countries which this use of an important product has brought about.

* Presented at the International Technical Meeting of the Technical Association of the Pulp and Paper Industry and the Technical Section of the Canadian Pulp and Paper Association, Montreal, P. Q., August 3-7, 1936.

[1] Member TAPPI, Secretary, News Print Service Bureau, New York.

TABLE I
CANADIAN NEWS PRINT PRODUCTION

Year	Tons	Per cent Exported
1913	350,000	73
1914	415,000	86
1915	489,000	86
1916	608,000	87
1917	686,000	87
1918	735,000	87
1919	803,000	88
1920	876,000	87
1921	808,000	88
1922	1,082,000	89
1923	1,266,000	90
1924	1,353,000	90
1925	1,522,000	92
1926	1,882,000	92
1927	2,087,000	90
1928	2,381,000	93
1929	2,729,000	92
1930	2,504,000	93
1931	2,221,000	90
1932	1,914,000	93
1933	2,017,000	91
1934	2,599,000	93
1935	2,753,000	94
1936	3,000,000(?)	95(?)

TABLE II
CANADIAN NEWS PRINT EXPORTS

Year	United States	Overseas	Total
1913	218,000	39,000	257,000
1914	310,000	48,000	358,000
1915	367,000	53,000	420,000
1916	473,000	53,000	526,000
1917	535,000	61,000	596,000
1918	577,000	60,000	637,000
1919	622,000	86,000	708,000
1920	670,000	92,000	762,000
1921	655,000	54,000	709,000
1922	888,000	72,000	960,000
1923	1,115,000	23,000	1,138,000
1924	1,192,000	27,000	1,219,000
1925	1,321,000	81,000	1,402,000
1926	1,628,000	104,000	1,732,000
1927	1,748,000	134,000	1,882,000
1928	1,935,000	272,000	2,207,000
1929	2,173,000	342,000	2,515,000
1930	2,008,000	325,000	2,333,000
1931	1,753,000	255,000	2,008,000
1932	1,520,000	257,000	1,777,000
1933	1,520,000	318,000	1,838,000
1934	1,960,000	454,000	2,414,000
1935	2,052,000	523,000	2,575,000
1936 (6 mos.)	1,112,000	248,000	1,360,000

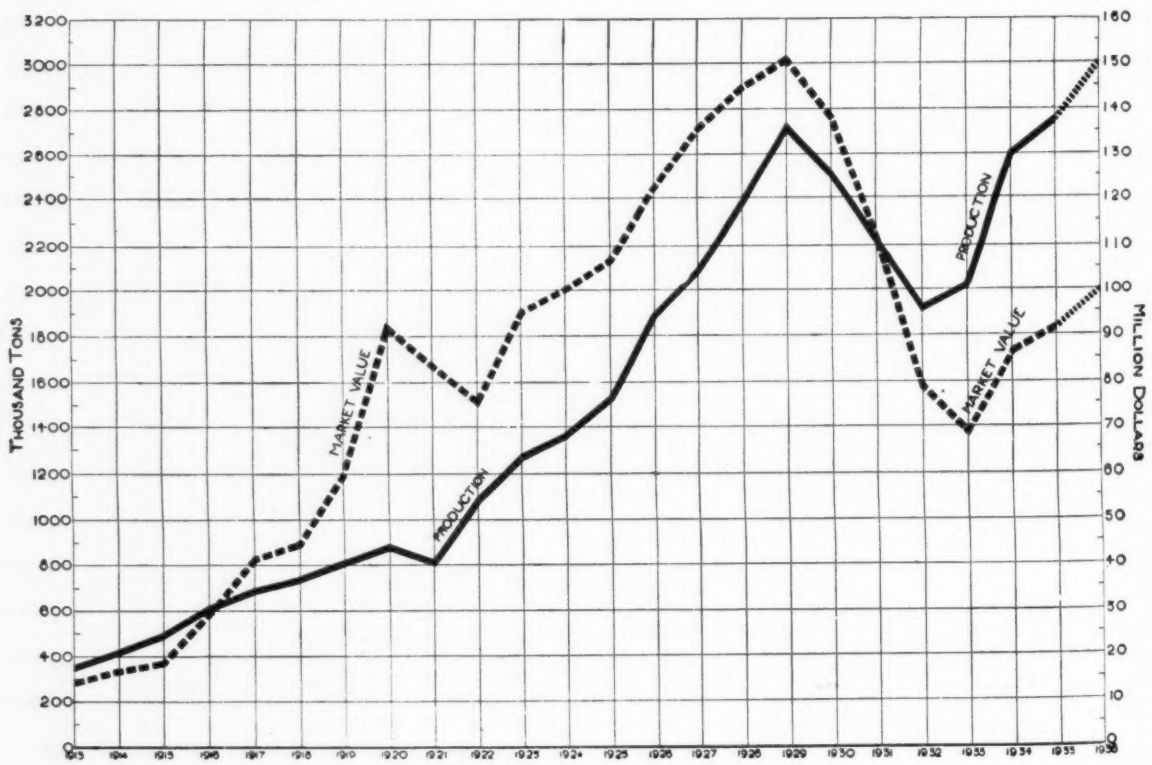
As a single example we can say that had it not been for this development there would be no such international meeting and exchange of mutually helpful ideas and experiences as we are entering upon today.

The Carnegie Endowment for International Peace has recently published a 350-page volume from presses in both the United States and Canada and under joint international authorship upon the subject of Canadian-American industry, which is commended to the attention of those who wish to go into the subject further. This volume is authority for the statement that almost $4,000,000,000 of American money is invested in Canada and that a proportionately larger amount of Canadian capital is invested outside of its frontiers. The reciprocal relationships of the United States and Canadian paper industry are among the strongest factors making for peace and friendship in a world filled with preparations for war.

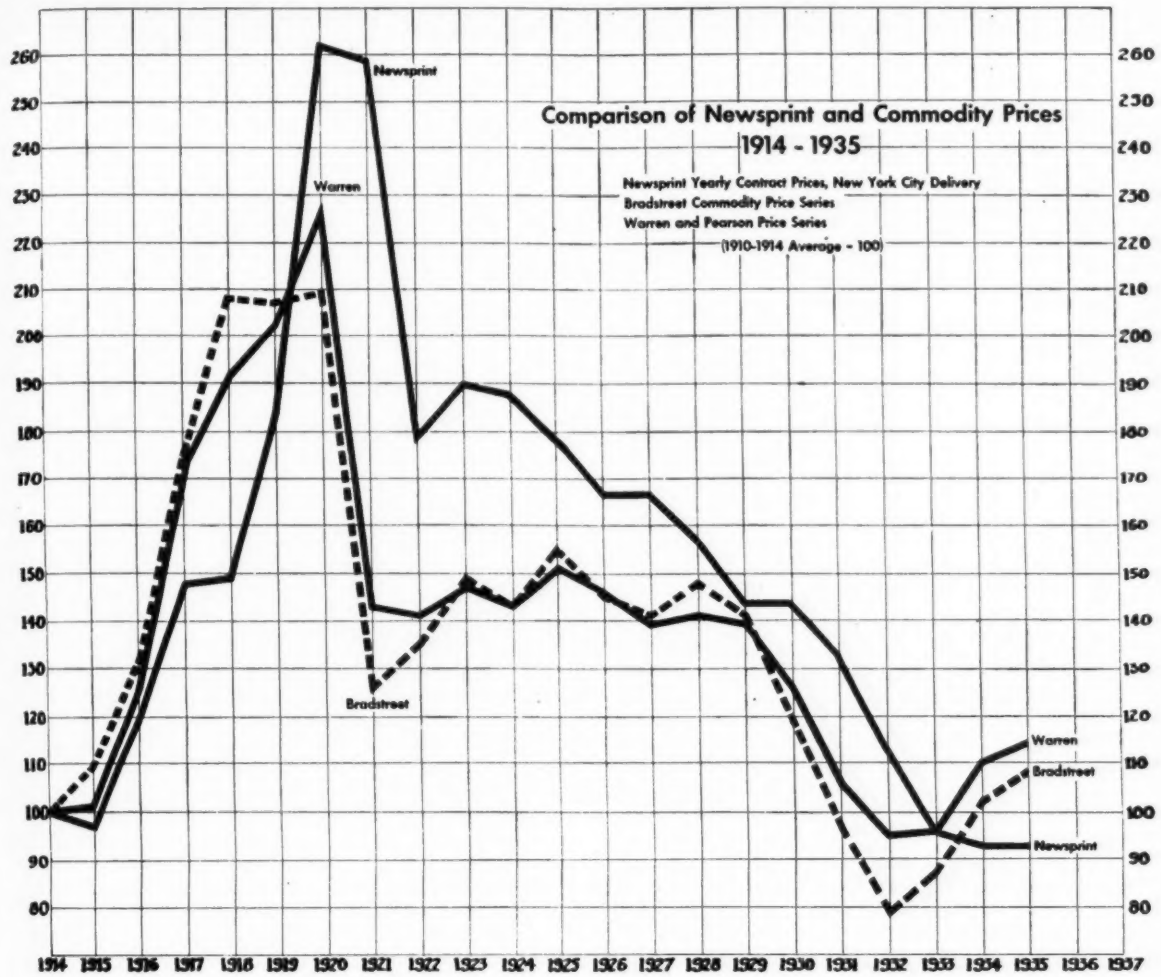
New Machines

The tremendous increase in the production of Canadian newsprint paper was, of course, chiefly brought about through the installation of new, larger and higher speed machines, although while this was going on additional equipment and improvements made possible greater production on older machines.

In the 12 years 1919-1930, inclusive, 91 new machines were added to the Canadian newsprint industry with a total initial rated capacity of 8,360 tons daily—and this capacity was in almost every case exceeded when these machines had opportunity to run full. Table IV shows the year by year record. Additional machines up to and including 1925 may be considered to have come in as a result of prospects for substantial and sustained demand for their product. In the 3 years of 1926, 1927 and 1928, however, we find the installation of 40 machines of more than 4,000



CANADIAN NEWSPRINT PAPER PRODUCTION AND MARKET VALUE



tons daily capacity, and to cap this 17 more machines of 1,700 tons capacity in 1929 and 1930. The world never saw anything anywhere else like this 12-year record of newsprint paper machine installation in Canada—and so far as one can judge never will see it again. And during the time these 91 machines were starting in Canada, 17 new machines were installed in the United States and 6 in Newfoundland, so that the total of 114 new machines in the 12 years had an initial rated capacity of more than 10,000 tons of newsprint paper daily. This was a great time for builders of machines and equipment. It also turned out to

TABLE III

NEWS PRINT AVAILABLE FOR CONSUMPTION IN THE U. S.

	Tons	Per cent Supplied by Canada		Tons	Per cent Supplied by Canada
1913	1,482,000	15	1925	2,955,000	44
1914	1,567,000	20	1926	3,517,000	47
1915	1,552,000	24	1927	3,461,000	51
1916	1,707,000	27	1928	3,563,000	54
1917	1,824,000	31	1929	3,796,000	58
1918	1,759,000	34	1930	3,551,000	56
1919	1,895,000	33	1931	3,212,000	55
1920	2,193,000	31	1932	2,793,000	55
1921	2,000,000	33	1933	2,728,000	57
1922	2,451,000	37	1934	3,148,000	62
1923	2,778,000	40	1935	3,272,000	63
1924	2,821,000	42	1936	3,575,000 (?)	63 (?)

TABLE IV

NEW CANADIAN NEWS PRINT MACHINES

Year	Number	Initial Daily Capacity
1919	3	150
1920	2	105
1921	7	435
1922	4	240
1923	6	415
1924	7	615
1925	6	565
1926	13	1215
1927	13	1400
1928	14	1485
1929	9	895
1930	7	840
Total	91	8360

TABLE V

AVERAGE CONTRACT PRICE PER TON OF NEWS PRINT PAPER

F.O.B.	Three Rivers	F.O.B.	Three Rivers
1913	$40.00	1925	70.00
1914	40.00	1926	65.00
1915	38.00	1927	65.00
1916	48.00	1928	60.70
1917	60.00	1929	55.20
1918	60.00	1930	55.20
1919	74.00	1931	50.20
1920	105.00	1932	41.13
1921	103.75	1933	34.05
1922	70.00	1934	33.20
1923	75.00	1935	33.20
1924	74.00	1936	34.20

TABLE VI

MARKET VALUE OF CANADIAN NEWS PRINT OUTPUT

(Based on Average Three Rivers Contract Price)		(Based on Average Three Rivers Contract Price)	
1913	$14,000,000	1925	106,540,000
1914	16,600,000	1926	122,330,000
1915	18,582,000	1927	135,655,000
1916	29,184,000	1928	144,527,000
1917	41,160,000	1929	150,641,000
1918	44,100,000	1930	138,221,000
1919	59,422,000	1931	111,494,000
1920	91,980,000	1932	78,723,000
1921	83,830,000	1933	68,679,000
1922	75,740,000	1934	86,287,000
1923	94,950,000	1935	91,400,000
1924	100,122,000	1936	100,000,000 (?)

be a great time for those whose money paid for these installations.

Price

In a free market, commodity prices are fixed by the supply-demand ratio, and newsprint paper is a beautiful illustration of this fact. Table V lists the average contract price per ton F.O.B. Three Rivers for the 24 years 1913-1936, inclusive. It tells the story of war inflation, post war deflation and the following depression. The table shows that the average contract price of newsprint F.O.B. Three Rivers was $38 per ton in the year 1915; it rose 177 per cent to an average of $105 per ton in 1920 and from that high level dropped 68 per cent to an average of $33.20 per ton in 1934 and 1935. The rise of $1 per ton in 1936 has been largely offset by increased costs.

The accompanying chart in which newsprint prices New York City delivery are compared with well-known commodity price series, is even more impressive. It shows most clearly what those of us of longer connection with the industry remember. That is, the war control of prices, the rebound to excessive levels when the brakes were taken off, the period when newsprint prices were above the general commodity level which stimulated overbuilding in the industry and the subsequent depression—which we are still in—with newsprint prices much below the general price level. It is an erratic course, the aftermath of which has been the loss of personal savings, the closing down of mills, community hardships and the wiping out of capital structures. We have seen that the great machine building boom terminated in 1930, just as the depression was getting under way. The combination of excessive building and decreased consumption put nearly 60 per cent of the Canadian newsprint industry into receiverships, defaults and similar financial straits from which it is yet far from recovered.

Market Prices

Applying the Three Rivers contract price to the total Canadian production, we get the yearly market values of output shown in Table VI. I realize, of course, that not all the Canadian newsprint has been sold at Three Rivers prices, but they are sufficiently representative to form a suitable basis for discussion purposes. On this assumption, Canadian newsprint had a mill value of $14,000,000 in 1913, $100,000,000 in 1924, $150,000,000 in 1929 with a slump to $68,000,000 in 1933. It will be back around $100,000,000 again in 1936, but this will be for some 3,000,000 tons of newsprint paper against 1,353,000 tons in 1924. On the basis of the 1924 price, therefore, we might say that Canada is turning out 1,700,000 tons of newsprint paper for nothing in 1936. At any rate all who are familiar with conditions will concede that an average mill price of about $34 per ton of newsprint paper is altogether too much a waste of good wood and hard work to be a pleasant experience. The accompanying chart brings out this relationship of total production to total value more clearly than any set of figures is able to do.

I do not want to close this brief resume without a word of cheer to my technical friends, however dark the outlook in recent years. Pulp and paper products are still on the make. There are no formidable substitutes for them in prospect. Many new uses are yet to come as the result of invention and discovery in a rapidly changing world. Money may have been lost, but machines, raw material and power remain. They will be put to work again. More than ever before there will be need for the engineer, the chemist, the electrician and the physicist for technical control, for research and for skilled management in a great industry. And that day is close at hand.

What Constitutes Validity of a Patent *

By Charles W. Rivise[1]

Abstract

A patent is a contract between the inventor and the Government, by the terms of which the inventor on complying with certain requirements may resort to the Federal Courts to restrain infringers. Granting of a patent raises presumption that it is valid, and infringers have the burden of proving invalidity. A holding of invalidity affects only the actual parties to the suit and may apply to only part of the patent. A patent may be valid in one part of the country and invalid in another. The Supreme Court may resolve conflicting decisions between different Circuit Courts of Appeal, but its decision is not binding on a different infringer. There have been relatively few patent suits in the pulp and paper industry within the last decade. A large proportion of the patents litigated in this industry within this period have been held invalid.

Prerequisites of Patentability

Our patent system has the twofold purpose of stimulating and encouraging inventiveness and ingenuity, and of inducing inventors to make public their inventions and discoveries. This it does by offering the inventor the right to exclude others from practicing his invention for a period of years[2], provided he makes such a full and exact disclosure of his invention that the public can practice it at the expiration of the inventor's monopoly. The document giving the inventor this right is a binding contract between the Government and the inventor, and is termed "letters patent" or simply "patent." To render his monopoly effective, the patentee is allowed the use of the Federal Courts to restrain infringers.

In order to take advantage of the protection afforded by the patent statutes, the inventor must comply with certain minimum requirements. Furthermore, the alleged invention or discovery must fulfill certain essential conditions.

The requirements and conditions essential to patentability[3] are as follows:

a. The invention or discovery must be directed to patentable subject matter.

b. The device of the invention must be useful.

c. The device of the invention must be new.

d. The new thing must have been created by the exercise of inventive ingenuity, and must involve invention over prior devices and practices.

e. The inventor must not have abandoned his invention or otherwise forfeited his right to patent protection.

* Presented at International Summer Meeting of Technical Associations of Pulp and Paper Industry and the Technical Section, Canadian Pulp and Paper Association, Montreal, P. Q., August 3-7, 1936.

[1] Member TAPPI, Patent Attorney, Caesar & Rivise, 1321 Arch Street, Philadelphia, Pa.

[2] The period of the monopoly is seventeen years in the case of all patents except those for designs.

[3] The requirements and conditions essential to patentability have been fully discussed by the present author in "What Is Patentable in Paper Making?" Paper Mill, 52, no. 39: 20, 22-23; no. 40: 18, 20, 26, 28 (Sept. 28, Oct. 5, 1929); Paper Trade J. 89, no. 14: 65-71 (Oct. 3, 1929); Pulp Paper Mag. Can. 28, no. 17: 629-632, 654, 656; no. 18: 690, 692, 694 (Oct. 24, 31, 1929); World's Paper Trade Rev. 92, no. 16: 1376, 1434, 1436; no. 17: 1474, 1476, 1516, 1518, 1520, 1522 (Oct. 18, 25, 1929); T. S. 91: 176.

f. The subject matter of the invention must be patentably distinct from that of any prior patents granted to the same inventor.

g. The inventor must file an application in the United States Patent Office adequately describing and clearly defining the invention, and prosecute it to the issuance of a patent.

Presumption of Validity

The fact that a patent has been granted by the Patent Office carries with it a *prima facie* presumption that its subject matter fulfills all of the essential conditions of patentability and that the patentee has complied with all of the necessary requirements.

The weight of the presumption varies with the circumstances of each case. Thus, the presumption of validity may be greatly weakened and even destroyed if it appears that the patent was issued without a thorough and careful examination by the officials of the Patent Office, or that it was granted through error or inadvertence.

In a number of cases, the presumption of validity was held to have been weakened by the fact that the examiner in granting the patents had failed or neglected to consider prior patents or publications disclosing very similar devices.

On the other hand, the presumption of validity is strengthened by a showing that the patent examiner made a full and careful examination of the application and finally granted the patent after considering closely similar devices. For this reason, the Courts rarely invalidate a patent on prior patents or publications which were considered by the Patent Office. In other words, the unbiased opinion of the patent examiner carries more weight with the Courts than that of defendant's expert.

The presumption of validity has greatly increased weight if the patent was granted on appeal after rejection by the patent examiner. The same holds true if the claim of invention had previously been upheld after being subjected to close and careful scrutiny under the stimulus of a heated contest such as an interference proceeding[4] in the Patent Office, or an infringement suit in the Courts.

The presumption of validity can also be greatly strengthened by showing that the public has recognized the merits of the invention and that the device has come into extensive use. For in most instances, the judgment of those who pay their money to secure the benefits of the patented article is better than the opinions and speculations of the most learned experts. In several cases, the Courts have stated that the test of public approval, if uninfluenced by detracting factors, must afford the weightiest proof obtainable that the invention possesses merit. This is particularly so, if the defendant himself has imitated the patented thing as closely as possible. For, the defendant would not have adopted the device of the invention and run the risk of an infringement suit, if it did not possess merit.

Patent Suits

A person sued for alleged infringement of a patent may avoid liability by proving that the patent is of such limited scope or breadth that it does not cover the alleged infringing device.

The alleged infringer may also defend on the ground that the patent is invalid. To sustain the defense of invalidity the defendant must prove beyond a reasonable doubt that the invention does not fulfill the minimum conditions essential to patentability, or that the inventor did not comply with all the requirements entitling him to patent protection.

[4] Contest of priority of invention between two or more rival inventors in the Patent Office.

The defendant may also avoid liability for his alleged infringing acts by proving one or more of the following facts:—

1. That the patentee delayed an unreasonable time in filing suit.

2. That the patentee had gained an unfair advantage over the defendant through deceit, reprehensible conduct or fraudulent means in respect to the patent in suit or a closely related patent.

3. That the patentee had delayed an unreasonable time in endeavoring to correct the patent aftr he had discovered that it did not afford him adequate protection or that it covered more than he had in fact invented.

It is to be noted that an alleged infringer cannot avoid liability by showing that the patent had been secured by fraud, deceit, collusion or illegal procedure. However, the alleged infringer may call the matter to the attention of the Attorney General who may institute appropriate proceedings to cancel the patent.

It is also to be noted that an alleged infringer cannot defeat the patent by showing that the inventor did not use the invention himself and refused to permit others to do so. The reason is that the patent had not been granted on condition that the patentee should make or sell the patented device or allow others to do so, but because the inventor had so clearly described his invention as to render it available to the public at the expiration of the patentee's monopoly. The only hope that the public has that an inventor will make his invention immediately available to them is the expectation that his self-interest will induce him to do so.

An alleged infringer need not wait until suit is filed against him in order to assert that the patent is invalid. Under the recently enacted Declaratory Judgment Act an alleged infringer may under certain circumstances bring suit to have the patent declared invalid.

Effect of Court Decision

A suit to enforce a patent or to have a patent declared invalid must be brought in the Federal Courts. The suit must in the first instance be filed in one of the District Courts, and the losing party may appeal to the Court of Appeals for the circuit within which the District Court is located[5]. The decision of the Circuit Court of Appeals is final, unless the Supreme Court of the United States consents to review the case.

The patentee has the choice of filing his suit in the district wherein the defendant resides, or in the district wherein the defendant has an established place of business and has committed an act of infringement. The selection of the district within which to file suit is a very important matter and may in a close case determine the outcome of the suit. For the ten Circuit Courts of Appeal vary considerably in their policy and view in respect to the proper interpretation of the patent statutes. Some are too strict; others are too lenient; and still others have too little patent work to be familiar with the more technical aspects of patent law.

A final decision in respect to the validity of a patent is, as a general rule, binding only on the actual parties to the suit. The fact that a patent has been held valid does not preclude another alleged infringer from urging that it is invalid. Likewise, the fact that a patent has been declared invalid does not in and of itself prevent the patentee from

[5] There are ten circuits in addition to the District of Columbia and each of these jurisdictions has its own Court of Appeals. Each of these Courts is supreme within its circuit, though their decisions are reviewable by the Supreme Court of the United States. However, the Supreme Court will not review Circuit Court decisions except under very exceptional circumstances. See "A Single Court of Patent Appeals," Paper Trade J. 93, no. 27: 20, 21 (Dec. 31, 1931).

filing another infringement suit against another infringer either in the same or a different circuit. However, the first decision is very persuasive upon the Court in the second suit, and the Court will not render a contrary decision unless it is convinced that the evidence adduced in the second suit justifies such decision. It follows that there may be situations in which a particular patent may be valid in one or more circuits and invalid in others. In such case the Supreme Court will generally grant a review in order to determine which of the two decisions is correct. However, a final decision by the Supreme Court is not binding upon persons other than the actual parties to the suit reviewed. Hence, if the Supreme Court finally holds the patent invalid, the patentee may again litigate the patent as against another infringer. Likewise, if the Supreme Court finally holds the patent valid, another infringer can again endeavor to prove the patent invalid.

The incubator patent (Patent No. 1,262,860) affords an excellent illustration of what has been said. This patent had been extensively litigated and held valid in a large number of suits in the Third, Sixth, Eighth and Ninth Circuits. However, several of the Circuit Courts disagreed as to the scope or breadth of the patent, and hence the Supreme Court granted a review. The Supreme Court finally held the patent valid[6] and of sufficient scope to cover many different forms of alleged infringing devices. Notwithstanding the fact that the patent had been consistently held valid, an independent infringer elected to stand suit in the Second Circuit and succeeded by means of evidence which had not been before the Supreme Court in proving to the Court that the patent was invalid[7].

There is one exception to the general rule that a decision in a patent case is conclusive and binding only on the actual parties to the suit. It appears to be well settled that a decision of validity may also be binding on a person who though not an actual party to the suit paid for or directed the defense. In Reo Motor Car Co. v. Gear Grinding Machine Co[8]., a decision of validity was held binding on members of a trade association who had contributed to a defense fund raised and administered by the association in a suit against a fellow member.

A decision of invalidity does not necessarily apply to the entire patent. If the patent contains more than one claim[9], the Court may in a proper case hold that some of the claims are valid and that the rest are invalid. For each claim of a patent is considered a separate and independent invention. One may be valid, all the rest invalid. But the claim that is good remains good and is unaffected by the presence of those that are bad. Likewise, one claim may be infringed and the others not. In other words, the patent does not stand or fall as a unity—each claim is in effect a separate patent. However, if some of the claims of a patent are finally held invalid, the patentee must within a reasonable time file a disclaimer in the Patent Office as to the claims held invalid. Otherwise, he will not be allowed to bring an infringement suit or recover damages as to the claims held valid.

Patent Litigation in the Pulp and Paper Industry

From what has been said, it is thought to be evident that patent litigation is very uncertain, expensive and burdensome to industry. Several very important patents spent almost their entire lives in Court before the question of their validity was finally decided. A notable instance is afforded by Eibel Patent No. 845,224 for an improvement in Fourdrinier machines. The Supreme Court finally held the patent valid[10] on February 19, 1923 and the patent expired on February 26, 1924.

The pulp and paper industry has been very fortunate in that it has been relatively free of patent litigation in the last decade. Only twenty-one patents have been before the Courts in this period. This number is insignificant when the immensity of the industry and the large number of unexpired patents are taken into consideration. It must also be borne in mind that the Patent Office is continuing to grant between 500 and 1000 patents a year of particular interest to this industry.

It is interesting to note that of the twenty-one patents litigated within the last ten years, ten have been held invalid. It is also to be noted that most of the decisions as to the invalid patents have been handed down within the last three years. This fact would appear to indicate that the Courts have recently become stricter in their interpretation of the requirements for patentability and validity.

Abstracts of Pulp and Paper Patents Litigated Within Last Ten Years[11].

Tulip Cup Corp. v. Ideal Cup Corp.[12]

In this case, the Court sustained Hill Patent No. 1,310,698 for a pleated paper drinking cup. The essence of the invention resided in placing a rolled rim on a single-piece cup blank so that the cup will not require any stiffening medium such as paraffin, and yet will be sufficiently stiff and firm for all practical purposes when in use.

Michigan Carton Co. v. Sutherland Paper Co[13].

Patent No. 1,316,120 to Sutherland covered a method of sealing waxed paper cartons. The method consisted in first dewaxing the surfaces to be joined, then applying glue and finally pressing the surfaces together. All the steps of the process were individually old in other processes, but they had never been combined in the manner disclosed in the patent in suit. The patent was therefore sustained as covering a new combination of process steps.

Guardian Trust Co. v. Downington Mfg. Co.[14]

This suit concerned Millspaugh Patent No. 1,025,822 for a combination in the Fourdrinier machine of a suction roll with a positive rotary vacuum pump which removes moisture from the wet paper web while on the making-wire, by forcing large quantities of air uniformly through it in the region of the couch roll. By a two to one decision the Court held that it did not involve invention to substitute a rotary pump for a reciprocating pump on a Fourdrinier machine, particularly since it was old to use such a pump on cylinder molds.

Louis Schopper and Foreign Paper Mills, Inc. v. Star Brass Mfg. Co.[15]

This suit concerned Patent No. 1,193,613 covering the Riegler freeness tester.

It was well known at the time of the invention that if a sample of paper pulp from the beater is poured on a screen, some of the water technically known as "freeness water" runs through almost immediately but that the rest of the water runs through slowly. Riegler's apparatus consisted of a vessel having two orifices, one for the "freeness water" and the other for the remaining water. By collecting the water from the two orifices, it was possible by means of

[6] Smith v. Snow, Reported in 294 United States Reporter 1 (1935).
[7] Smith v. Hall, Reported in 83 Fed. Rep. (2nd) 217 (C. C. A. 2—1936).
[8] Reported in 42 Fed. Rep. (2nd) 965 (C. C. A. 6—1930).
[9] The claims may be defined as the short statements at the end of the patent wherein the patentee points out the part, improvement or combination which he deems to constitute the essence of his invention.

[10] Eibel Process Co. v. Minnesota & Ontario Paper Co., Reported in 261 United States Reporter 45 (1923).
[11] These abstracts are based upon the opinions of the Courts and do not necessarily represent the opinions of the present author.
[12] Reported in 27 Fed. Rep. (2nd) 717 (C. C. A. 2—1928).
[13] Reported in 29 Fed. Rep. (2nd) 179 (C. C. A. 6—1928).
[14] Reported in 29 Fed. Rep. (2nd) 887 (C. C. A. 3—1928).
[15] Reported in 34 Fed. Rep. (2nd) 664 (D. Mass. 1927).

Riegler's apparatus to judge the condition (freeness) of the stock by the relative amounts of water in the two vessels. Riegler was the first inventor to devise a practical device to ascertain the condition of the stock with reference to freeness and thereby with respect to beating. The Court therefore sustained the patent and held that it covered a pioneer invention.

International Burr Corp. v. Wood Grinding Service, Inc.[16]

This suit concerned Hall Patent No. 1,132,258 covering a method and an apparatus for producing wood pulp suitable for making paper.

The method consisted in subjecting the wood to successive abrasive actions in a direction substantially perpendicular to the length of the fibers and protecting those fibers already separated from being broken by subsequent abrasive action. The method was carried out by means of a grindstone having a particular type of marking on its face.

The patent was held invalid as covering substantially the same process and apparatus disclosed in Millard Patent No. 1,118,671. The Court was also of the opinion that the method was anticipated by a process which had been developed at the Forest Products Laboratory at Wausau by MacNaughten and Thickens and disclosed in a Government publication.

A. B. Dick Co. v. Simplicator Corp[17].

Patent No. 1,526,982 covered a stencil sheet coated with a cellulose ester. The use of a cellulose ester on a base of Yoshino paper rendered it unnecessary to moisten the stencil sheets temporarily before they were used. The patent was held valid as covering an important advance in the stencil art.

S. M. Langston Co. v. Mengel Co[18].

This suit concerned Patents Nos. 1,489,135 and 1,660,844, both of which covered devices for cutting continuously moving webs of corrugated paper. Both patents were sustained.

S. M. Langston Co. v. F. X. Hooper Co. Inc[19].

Patents Nos. 1,850,800 and 1,850,802 covered a device called a "running register" for printer and slotter machines. A printer-slotter is a machine which prints and slots successively fed sheets of stiff corrugated board to convert said sheets into blanks for making shipping cartons or boxes. A running register is a device whereby the so-called "set-up" time of the machine is materially reduced, and minor adjustments in registry may be made without stopping the machine.

The various elements of the two patents were shown to be old in other machines such as cigarette making machines and internal combustion engines, but the patents were sustained because the prior devices were in non-analogous arts and the patentee had by the use of old elements created a new combination of elements which produced new and important results in the art of printing and slotting machines.

Masonite Corp. v. Celotex Corp.[20]

E. I. Du Pont de Nemours & Co. v. Glidden Co.[21]

Flaherty Reissue Patent No. 16,803 was directed to a nitrocellulose lacquer, and was based upon the discovery that to produce an effective lacquer of thick coating quality, the viscosity characteristic of the nitrocellulose must be below 4.6 seconds, a critical limit which was considerably lower than had previously been considered practical.

The Court in sustaining the patent stated: "If Flaherty did no more than disabuse the art of a misconception, it is evidence of originality; most of us persist in what we are accustomed to believe. Though all he did was to carry forward the existing knowledge that lower viscosity would result in greater coverage, other competent persons had tried to use that knowledge; the stimulus to success was great, and the art had been strangely inert, if the combination was obvious, or obsessed with the belief that low viscosity was impractical. The result was a new and unexpected product, recognized as such and used to much advantage."

Process Engineers, Inc. v. Container Corp. of America[22].

De Cew Patent No. 1,589,947 was directed to a method of sizing paper, which consisted in adding the size and the alum to the paper stock after the fibers of said stock had passed through the Jordan.

The patent was held invalid, because the Court was convinced that substantially the same process had been carried out prior to De Cew's invention at the plants of the Falulah Paper Company and the Niagara Paper Mills.

Carson v. Indiana Fibre Products Co[23].

Prior to Patent No. 1,731,636 two machines were used for making pie plates from paper. One was a paper cutting machine and the other a paper forming machine. It was the usual practice to feed a paper sheet by feeding rolls to rollers which removed curls in the paper, after which the paper moved under a plurality of cutting dies in staggered relation. The cutting dies cut out circular disks which dropped to a point below. These circular disks were removed by hand and fed to the forming machine which was located nearby.

The patentees combined both machines in one whereby the product of the first machine was automatically fed to the second machine by means of a trough, the cutting and forming dies in the two machines being operated in synchronism.

The Court was of the opinion that it did not constitute patentable invention to position parts of a machine so as to make use of troughs etc. to convey an uncompleted product from one machine to another or another part of the same machine. The patent was therefore held invalid.

Samuel M. Langston Co. v. Continental Container Corp[24].

This case involved Sieg Patent No. 1,897,867 for a cutter for corrugated paper. The Court did not pass upon the validity of the patent, because it was of the opinion that the patent was not of sufficient scope or breadth to cover the device used by the defendant. In other words the Court held that the patent, assuming that it was valid, had not been infringed by the defendant.

Black-Clawson Co. v. Centrifugal Engineering & Patents Corp[25].

Prior to Thomassen Patent No. 1,536,988 the conventional method of removing sand, grit or metallic substances from paper stock was by running the material through a

[16] Reported in 34 Fed. Rep. (2nd) 905 (C. C. A. 2—1929).
[17] Reported in 34 Fed. Rep. (2nd) 935 (C. C. A. 2—1929). The patent in suit was also sustained in each of the following cases:
A. B. Dick Co. v. Shallcross Corp., 42 Fed. Rep. (2nd) 169 (C. C. A. 2—1930).
Arlac Dry Stencil Corp. v. A. B. Dick Co., 46 Fed. Rep. (2nd) 899 (C. C. A. 3—1931).
Heyer Duplicating Co. v. A. B. Dick Co., 59 Fed. Rep. (2nd) 787 (C. C. A. 7—1932).
A. B. Dick Co. v. Shallcross, 72 Fed. Rep. (2nd) 269 (C. C. A. 2—1934).
[18] Reported in 60 Fed. Rep. (2nd) 151 (W. D. Kentucky 1932).
[19] Reported in 8 Fed. (Supp.) 613 (D. Maryland 1934) affirmed in 79 Fed. Rep. (2nd) 992 (C. C. A. 4—1935).
[20] Reported in 66 Fed. Rep. (2nd) 451 (C. C. A. 3—1933). See Bulletins 16 and 23 of TAPPI Patents Committee, Paper Trade J. 95, no. 22: 25 (Dec. 1, 1932), 97, no. 19: 39 (Nov. 9, 1933) for a complete discussion of this decision.

[21] Reported in 67 Fed. Rep. (2nd) 392 (C. C. A. 2—1933).
[22] Reported in 70 Fed. Rep. (2nd) 487 (C. C. A. 7—1934).
[23] Reported in 76 Fed. Rep. (2nd) 731 (C. C. A. 7—1935).
[24] Reported in 80 Fed. Rep. (2nd) 847 (C. C. A. 2—1936).
[25] Reported in 83 Fed. Rep. (2nd) 116 (C. C. A. 6—1936).

sand trap or grit retainer, the pulp having to flow over successive bars in a trough whereby the heavier impurities were separated from the stock by the force of gravity. Lighter impurities, such as knots, or improperly divided fiber, were removed by a strainer in the form of a fine meshed sieve.

Thomassen perceived the imperfections of the sand trap, in that it permitted many of the heavy impurities to pass because of the clogging of the material at the retarding bars, where it freed itself in comparatively large masses. He approached the problem from a different angle and sought to substitute for the sand trap a device by which the heavier particles would be thrown from the paper pulp by centrifugal force without at the same time removing the fibers which themselves possess a higher specific gravity than the water in which they are suspended, and with provision for the removal of lighter impurities before the stock was permitted to continue its flow.

Thomassen's patent described a particular form of centrifugal separator, and disclosed a method of operating the device consisting in continuously supplying the pulp to the separator, rotating the separator at a speed sufficient to accumulate the pulp in a substantially cylindrical layer, collecting the heavier impurities at the outside of the layer, collecting the lighter impurities at the inner surface of said layer and discharging the purified pulp from between said impurities.

The patent contained both method and apparatus claims. The owner of the patent sued only on the method claims, because the defendant did not employ the centrifugal machine described and claimed in the patent. However, the defendant operated its machine in the same manner as covered by the claims; i. e. the separator was rotated at such a speed that the pulp formed a substantially cylindrical layer.

The prior art contained three patents disclosing centrifugal separators for taking impurities out of paper pulp. One of the patents was Patent No. 813,984 issued to MacNaughten. None of the patents disclosed the same method of operating the separator as claimed by the Thomassen patent.

In holding the method claims invalid, the Court stated:—

"It is the building up by appropriate speed of rotation of the substantially cylindrical vertical wall of paper stock with the consequent formation of the fibrous mat that furnishes the vitalizing step of the Thomassen machine. But the defendant's response is that this cylindrical wall of pulp is but the inevitable result of the operation of the Thomassen machine. It is therefore urged that no patentable method is disclosed since it cannot be performed either by hand or by any other known apparatus, and that the claims are so broad as to exclude all other inventors who might accomplish the same result by means or methods unknown to Thomassen, and this leads us to what we consider the controlling point in the case—a determination as to whether or not the claims are functional.

"It is now well settled that operations which consist entirely of mechanical transactions, and which are only the peculiar functions of the respective machines which are constructed to perform them, do not constitute processes which are patentable in the United States. . . . . .Though formerly debatable, it is also now settled that operations which consist entirely of mechanical transactions, but which may be performed by hand or by any of several different mechanisms or machines, are patentable as processes or arts. . . . . .

"It is not suggested that the Thomassen method may be performed by hand, but a complete answer to the contention that the claims are functional is asserted to lie in the fact that the patented method is being carried out by other machines than the one shown in the patent, notably the machines made by the licensees operating under the patent—the Bird 'centrifiner' and the Tolhurst machine, as well as the defendant's machine, which are said to differ from the machine shown in the patent as well as from one another. But all of these machines are centrifugal separators. It certainly cannot be the rule that claims escape the condemnation that they are functional by the mere reorganization of the patented machine, when the principle of operation remains identical. . . . . And a process which cannot be described otherwise than by describing the characteristic function of a machine is not validated by showing it may be carried on by another machine which has the same characteristic function in respect to the precise result to be attained. To say that the effect produced by one centrifuge is not functional because the same effect may be produced by another centrifuge is to beg the question. We think the claims here involved are clearly functional. . . . . .

"Nor is it in our judgment any answer to the functional challenge to say that there is nothing inherent in the nature of a centrifugal machine which requires that it be operated at a speed sufficient to accumulate the pulp in a substantially cylindrical layer. One might make a similar observation in respect to any machine. A machine is designed to accomplish a certain result when operated at a certain speed. To describe a process in terms that tell what happens when the speed is attained, or conversely to determine appropriate speed by a certain result when reached, is to describe the operation of the machine. The claims here are clearly drafted to cover any means or method which any one may ever discover for producing the same result."

American Lakes Paper Co. v. Nekoosa-Edwards Paper Co[26].

This suit concerned Seaborne Patent No. 1,517,018 for a watermaking roll for a paper machine.

Prior to this patent it was old to make a watermarking roll having a metal core, an outer hard rubber design-bearing sleeve and an interposed cushioning sleeve of soft rubber. Seaborne contended that it was impossible to vulcanize the soft rubber cushioning sleeve to the metal core and suggested interposing a sleeve of hard rubber between the cushioning sleeve and the core. This expedient appeared to be very old and the patent was therefore held invalid.

It is interesting to note that the defendants did not use a hard rubber layer to unite the metal core to the cushioning layer. Instead they used the patented cement called "Vulcalock." The Court held that the use of this cement avoided infringement of the patent.

Raffold Process Corp. v. Castanea Paper Co[27].

This suit involved the following four patents issued to Rafton and assigned to the plaintiff:—

Patent No. 1,803,642 issued May 5, 1931.

Patent No. 1,819,441 issued Aug. 18, 1931.

Patent No. 1,831,928 issued Nov. 17, 1931.

Patent No. 1,848,659 issued March 8, 1932.

All the patents related to processes or procedures employed in the manufacture of paper containing an alkaline filler such as calcium carbonate.

Patent No. 1,803,642 was based upon the theory that the time and intimacy of contact between the carbonate fill-

[26] Reported in 29 United States Patents Quarterly 551 (C. C. A. 7—1936).

[27] This is a District Court decision and is appealable to the Circuit Court of Appeals for the Third Circuit. The complete text of the decision was published in Paper Trade J. 102, no. 18: 13, 37-40 (April 30, 1936).

er and the sizing materials must be reduced to a minimum to avoid destruction of the sizing materials. The patented method consisted in adding the filler to the stock where it exists in a dilute state immediately before its delivery to the web-forming end of the paper machines where the two alleged warring elements would be in contact for only a few seconds up to five minutes.

The Court invalidated the patent on the ground that it was old to add the carbonate filler at every possible point in the paper-making process, and stated: "It is inmaterial whether the prior art discloses the same purpose as Rafton or not, because it is the process that is patentable, and not the theory of its operation."

The Court also decided that there was no question of infringement, because the defendant made a substantially unsized paper and added the carbonate filler in the machine chest where it remains in contact with the other ingredients of the furnish for about two hours.

Patent No. 1,831,928 related to the use of starch in paper-making for the purpose of substantially eliminating deleterious foaming in the manufacture of paper. The patent disclosed the use of starch or starch and alum with carbonate filler in any case where uncontrollable foam would be encountered if starch were omitted.

The Court found as a fact that starch has been used as an ingredient in paper-making for years, and concluded that it was not patentable to use the starch for a new purpose; i. e., to kill the foam engendered in the use of carbonate fillers.

The Court also stated that the defendant did not infringe the patent, because the evidence did not indicate that any uncontrollable foam was produced in defendant's process.

Patents Nos. 1,819,441 and 1,848,659 covered methods of using paraffin emulsions in paper-making and the resultant products.

In Patent No. 1,819,441 Rafton proposed adding the paraffin emulsion and filler to the paper stock before alum in order to prevent the formation of coarse flakes or lumps of paraffin.

The Court invalidated the patent on the ground that Miles Patent No. 1,229,580 showed it was old to precipitate a paraffin emulsion size in paper stock by the added filler in lieu of, or before the addition of alum, and that this procedure was used by the S. D. Warren Co. in 1926. The Court also held that the defendant did not infringe the patent because it used a rosin size with a small proportion of paraffin and did not add the filler until after the size was precipitated with alum.

In Patent No. 1,848,659 Rafton proposed adding the emulsion and alum to the paper stock before the filler was added. The Court invalidated this patent on the ground that the procedure covered by the patent was old and on the additional ground that in Patent No. 1,819,441 Rafton had admitted this procedure to be old.

Simplified Method for the Rapid Determination of the Available Chlorine Content of Pulp Bleaching Solutions*

By Donald T. Jackson[1] and John L. Parsons[2]

Abstract

For determining the available chlorine content of hypochlorite solutions in the control of pulp bleaching the method of Pontius has been modified to include an inside indicator so that only a single reagent is employed by the operator. The procedure is simple and rapid and has been successfully employed in a pulp mill for several years by mill operators. Comparative analyses of a series of hypochlorite solutions using the arsenite method and the Pontius method show good agreement between the two.

For the control of the pulp bleaching process it is desirable for the operator to know the available chlorine content of the hypochlorite solution at frequent intervals during the bleaching operation. For this purpose a simple and rapid analytical procedure is required. The analytical method of Pontius *(1)* was slightly modified in order that the operator by using a single reagent could quantitatively determine the available chlorine content of a sample of bleach solution within a few minutes. By employing this procedure the use of an external indicator or of several chemical reagents, required by other methods, is eliminated.

The modified Pontius method involves the titration of the bleach sample with one standard solution containing its own indicator. This simplified procedure has been successfully employed by mill operators for several years in the process control of bleaching.

The Pontius method depends on the fact that in a sodium bicarbonate solution, hypochlorites quantitatively oxidize potassium iodide to potassium iodate according to the following equation:

$$3\,Ca(OCl)_2 + 6\,NaHCO_3 + KI \rightarrow KIO_3 + 6\,NaCl + 3\,CaCO_3 + 3\,CO_3 + 3\,H_2O$$

When the hypochlorite is entirely decomposed the following reaction occurs:

$$KIO_3 + 5\,KI + 6\,H_2CO_3 \rightarrow 3\,I_2 + 6\,KHCO_3 + 3\,H_2O$$

The liberated iodine then reacts with the starch in the solution to give the characteristic blue color indicating the end-point.

Preparation and Standardization of Reagent

The standard solution is made by first dissolving 1.683 grams C.P. potassium iodide and 50 grams C.P. sodium bicarbonate in about 500 cc. distilled water. Then the starch indicator is prepared by mixing 2 grams soluble starch with sufficient cold water to make a thin paste. Pour this paste into 200 cc. boiling water. Boil for a few minutes, cool and decant off the clear starch solution. About 1 cc. chloroform may be added as a preservative. Add the starch solution to the iodide-bicarbonate solution, already prepared, and dilute with distilled water to exactly one liter in a volumetric flask.

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[1] Member TAPPI, Research Chemist, Hammermill Paper Co., Erie, Pa.
[2] Member TAPPI, Research Chemist, Hammermill Paper Company, Erie, Pa.

This modified Pontius reagent should be standardized against a hypochlorite solution, the available chlorine content of which has been accurately determined by the usual arsenite method. A hypochlorite solution containing about 0.06 per cent available chlorine is satisfactory for this purpose. The strength of the Pontius reagent should be adjusted so that 1.0 cc. is equivalent to 0.0020 gram available chlorine, this having been found to be a convenient concentration to use for testing hypochlorite solutions during the bleaching of pulp. This adjustment can be made by varying the potassium iodide content of the Pontius reagent.

Procedure

One hundred cubic centimeters of the bleach solution to be tested are accurately measured in a volumetric flask and placed in a 400-cc. beaker or Erlenmeyer flask. The sample is titrated directly with the standard Pontius reagent contained in a burette. A 100-cc. burette graduated into 1.0 cc. intervals has been found satisfactory for control purposes. The standard solution must be *slowly* added, allowing it to drop from the burette and never to run in a continuous stream. The liquid in the beaker or flask should always be continuously stirred during the titration. The appearance of a pale blue color in the solution indicates the end-point.

There appears to be a noticeable time-interval required for the reactions in this determination to take place. If the Pontius reagent is allowed to run in rapidly, the true end-point may be overstepped by several cc. Stirring of the solution aids these reactions and should always be carried out.

Calculation

When a 100-cc. sample of bleach solution is used, the percentage of available chlorine is equal to the number of cubic centimeters of reagent consumed multiplied by 0.002.

The general expression for the calculation is as follows, assuming that 1.0 cc. of the standard Pontius reagent is equal to 0.0020 gram available chlorine:

$$\text{Per cent Available Chlorine} = \frac{\text{cc. Pontius reagent} \times 0.2}{\text{cc. Bleach Solution}}$$

Notes

1. In taking a bleach sample from the bleacher the pulp fibers are easily removed by placing the mixture in clean cotton cloth and squeezing the liquid to be tested in a beaker.

2. The amount of C.P. potassium iodide required per liter of standard reagent has been found by experience in one mill to be 1.683 grams. This figure may vary a little, depending on the purity of the iodide. The quantity used should be such that 1 cc. standard reagent is equivalent to 0.0020 gram available chlorine.

3. The standard Pontius solution has been found to maintain its strength satisfactorily for several weeks although it is recommended that the solution be standardized once a month against a hypochlorite solution of known concentration.

4. Emphasis should be placed on the necessity of carrying out the titration *slowly* to allow adequate time for the reactions to occur before the end-point is reached.

5. The following tabulated data give comparative results on the titration of hypochlorite solutions (1) by the usual arsenite method and (2) by the Pontius method.

Bleach Sample	Per Cent Available Chlorine (1) Arsenite Method	(2) Pontius Method
1	0.290	0.291
2	0.0916	0.0886
3	0.0771	0.0769
4	0.0614	0.0625
5	0.0595	0.0598
6	0.0562	0.0558
7	0.0423	0.0423
8	0.0330	0.0340
9	0.0250	0.0255
10	0.0235	0.0230
11	0.0221	0.0260
12	0.0170	0.0200
13	0.0126	0.0152
14	0.0104	0.0133
15	0.0102	0.0143

Each of the above figures is an average of closely agreeing duplicate tests. The agreement between the two methods is quite satisfactory for process control purposes. With concentrations of available chlorine below 0.02 percent, the Pontius method usually gives a slightly higher value than the arsenite method, as indicated by the above data. Using a 50-cc. burette graduated into 0.1 cc. divisions it is possible to obtain duplicate results with the Pontius method, checking within 0.0004 percent available chlorine.

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The Liming of Digesters*

By C. F. B. Stevens[1] and W. H. Birchard[2]

Abstract

The deposit responsible for the liming of digesters has been analysed and found to consist principally of calcium sulphite. If present in a digester in large amount, it is probably a sign that the cooking temperature is being raised too fast with consequent danger of burning the pulp.

Sooner or later every sulphite operator finds himself with a limed digester, and considerable controversy has arisen as to the composition and the mechanism of deposition of the scale.

It is well known that calcium sulphite is only slightly soluble in cold water and less soluble in hot water, but readily soluble in an acid solution such as sulphurous acid, due to the formation of bisulphite. This solubility plays a very important part in the cooking of chips with sulphite liquor and must not be overlooked.

If at any time the acid concentration is permitted to drop below the critical point calcium sulphite will precipitate out. This depletion is usually due to too rapid a rise in the cooking temperature, which may cause the reduction in acid concentration, in the liquor surrounding the chips, in two ways. By raising the temperature too fast the sulphurous acid is broken up and the sulphur dioxide relieved without being of any value. The increase in temperature also increases the rate of penetration of the cooking liquor into the chips. The components of the cooking liquor, namely the acid and base, penetrate at different rates; and the temperature curve should be arranged so that the acid penetrates at a rate only slightly faster than that of the base. In this way the lignosulphonic acid formed is neutralized

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[1] Assistant Chemist Fraser Companies Limited, Edmundston, N. B.
[2] Chief Chemist, Fraser Companies Limited, Edmunston, N. B.

before it has a chance to hydrolyze the cellulose fiber. If the acid is caused to penetrate at a much faster rate than the base, it is found that a point is soon reached where the acid concentration is not sufficient to keep the sulphite in solution and it is precipitated.

It has been observed that this precipitation takes place under definite conditions of temperature and pressure during the cook *(1)*, *(2)* and can be made to occur or prevented by adjusting the temperature curve.

The scale removed from the outlet of the digester becomes difficult to analyse due to the presence of organic compounds formed during the cook.

The following is the description of a method of analysis which permits a complete inorganic analysis of this deposit and indicates its chemical composition.

Samples were taken from the digester blow-valve fitting. Each consist of several layers of varying shades. They were air-dried, ground, and dried in an oven at 95 deg. C.

1. Residue on Ignition *(3)*

On ignition at 900 deg. C. sulphites appear partly to oxidize and reduce to sulphates and sulphides—

$$4CaSO_3 \rightarrow 3CaSO_4 + CaS$$

and no definite result can be obtained. Samples were therefor ignited to sulphates as follows:

A 0.5 gram sample was weighed out in a platinum crucible, moistened with water, treated with 1 cc. conc. H_2SO_4, heated very gently until reaction had ceased, and evaporated to dryness on a hot plate under a hood. It was cooled and the procedure repeated; it was then ignited in a muffle at 900 deg. C. for 15 minutes, put through the procedure again, ignited, cooled and weighed.

The result was checked against the total of the acid insoluble, plus the R_2O_3, plus the calcium and magnesium calculated to sulphates.

2. Acid Insoluble

1.0 gram samples were weighed out in tared beakers; 50 cc. hot H_2O and 15 cc. conc. HCl were added, the solution boiled for 10 minutes and filtered. The papers were washed with hot H_2O, ignited, cooled and weighed as acid insoluble.

3. R_2O_3

Precipitated by ammonium hydroxide in the filtrate from (2) above.

4. CaO

Precipitated by ammonium oxalate in filtrate from (3) above, ignited, redissolved, filtered and reprecipitated.

5. MgO

Precipitated by disodium hydrogen phosphate in the filtrate from (4) above.

6. SO_2

(1) After Barsky's method *(3)*

A 250 cc. rubber-stoppered flask was placed inside a felt-covered can containing crushed ice and salt. 5-10 cc. conc. HCl and 150 cc. H_2O were poured into the flask and allowed to cool.

A sample weighing about 0.4 grams was then introduced from a weighing-bottle, the flask stoppered, shaken, and set aside in the freezing mixture for 15 minutes.

The approximate amount of 0.1 NI_2 solution required was then calculated and added quickly from a burette.

The flask was then removed from the freezing-mixture, shaken, thawed if necessary, and the titration finished, using starch water as indicator.

According to Scott, however *(4)*, the iodine should always be in excess to avoid the reaction.

$$4HI + SO_2 \rightarrow 2H_2O + 2I_2 + S$$

The following method was therefore carried out:

(2) 10 cc. conc. HCl and 50 cc. H_2O were placed in a 250 cc. glass-stoppered volumetric flask. 100 cc. 0.1 NI_2 were pipetted in. The sample was then put in; the flask stoppered, swirled and let stand for 15 minutes. The solution was then back-titrated with 0.1 N-$Na_2S_2O_3$.

Results:		1	2	Average
Method	(1)	38.46	38.39	38.43 % SO_3
	(2)	38.59	38.45	38.52

7. SO_3

1.0 gram sample was dissolved in 100 cc. hot 15 per cent HCl, the solution boiled for 1 hour, filtered and washed into a 2 liter beaker. $BaSO_4$ was precipitated in 1600 cc. of the cold solution according to the method of Hillebrand and Lundell *(5)*.

8. To Find any Sulphur (E.G. in Sulphones) Missed by (6) and (7):

A 1 gram sample was fused with 5 grams Na_2CO_3 and 1 gram $KClO_3$ in a platinum crucible; the melt digested twice with hot H_2O, filtered and washed. The SO_3 was determined in the filtrate as in (7) above.

Note: The carbonate precipitate can serve for the determination of R_2O_3, CaO and MgO.

(9), (10) Ether and Alcohol Soluble Matter.

A 1 gram sample was placed in a Whatman thimble and extracted in the usual way in a Soxhlet; first with ether, then with alcohol. The extract was dried in a tared Vitreosil Petri dish.

Results:	1 %	2 %	Average %
1. Residue on Ignition to sulphates	98.60	98.56	98.58
CaO, MgO, calc. to sulphates + acid incol. + R_2O_3			99.44
2. Acid insoluble	0.95	0.51	0.73
3. R_2O_3	0.69	0.75	0.72
4. CaO	39.97	39.90	39.94
5. MgO	0.27	0.41	0.34
6. SO_2 (2nd method)	38.59	38.45	38.52
7. SO_3	8.87	9.09	8.92
8. Total S determined as SO_3	56.48	56.50	56.49
Total S found in (6) and (7) calculated to SO_3			57.12
Total inorganic matter (2), (3), (4), (5), (6), (7)	89.34	89.11	89.28
Organic matter by difference			11.00
Organic matter composed of:			%
Alcohol soluble (insol. in ether)			2.61
Other org. matter (by difference)			8.00
Probable Composition			%
$CaSO_3$			72.24
$CaSO_4$			15.11
Acid insoluble			0.73
R_2O_3			0.72
$MgSO_4$			0.14
MgO			0.29
			89.23
Pitch			3.20
Other organic matter			8.00

Acknowledgement

Acknowledgement is made to the Fraser Companies, Limited, for their kind permission to publish this paper.

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Characteristics of Ground Wood Pulp for High Speed Newsprint Machines*

By L. E. Kendall[1]

Abstract

Data from units running at various speeds indicate that higher speed machines will require a higher freeness test on the groundwood pulp furnish. The only data available about the classification of pulps for use at different speeds does not indicate any satisfactory distinction between them but other tests on the same pulps indicate that higher tests of freeness, burst, and tear have been used at higher speeds.

It appears that higher freeness and strength tests will give pulps which will be satisfactory for higher speeds.

It is not clearly indicated how the higher speed pulps differ physically from those used at slow speeds but is suggested that they should be longer and more slender. It is doubtful whether they should be more fibrillated.

The only means at hand for producing these pulps appear to be a closer refinement in carrying out the groundwood process and a more expert performance by the crew, who produce the pulp.

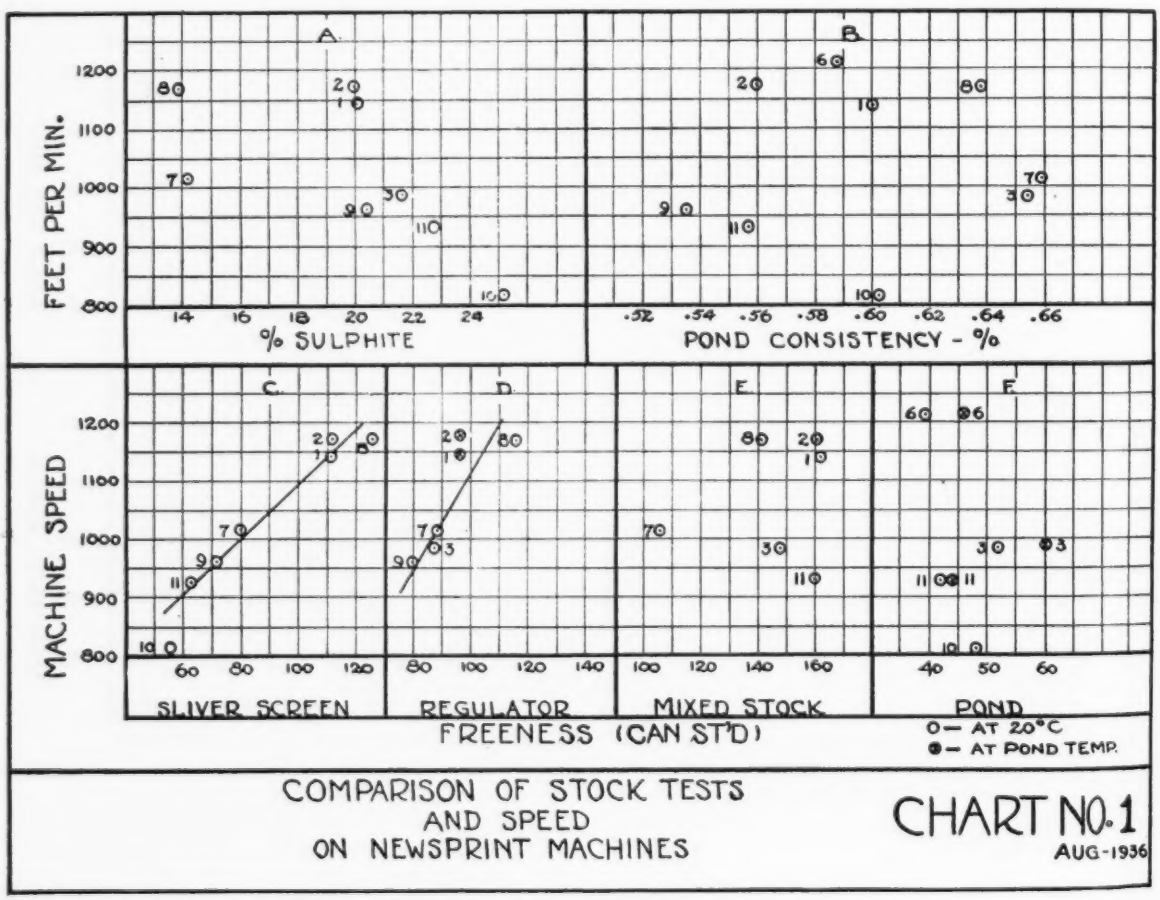
* This paper is a contribution of the Ground Wood Committee of the Technical Section of the Canadian Pulp and Paper Association and presented at the International Meeting of the Technical Association of the Pulp and Paper Industry and the Technical Section of the Canadian Pulp and Paper Association at Montreal, P. Q., August 3-7, 1936.

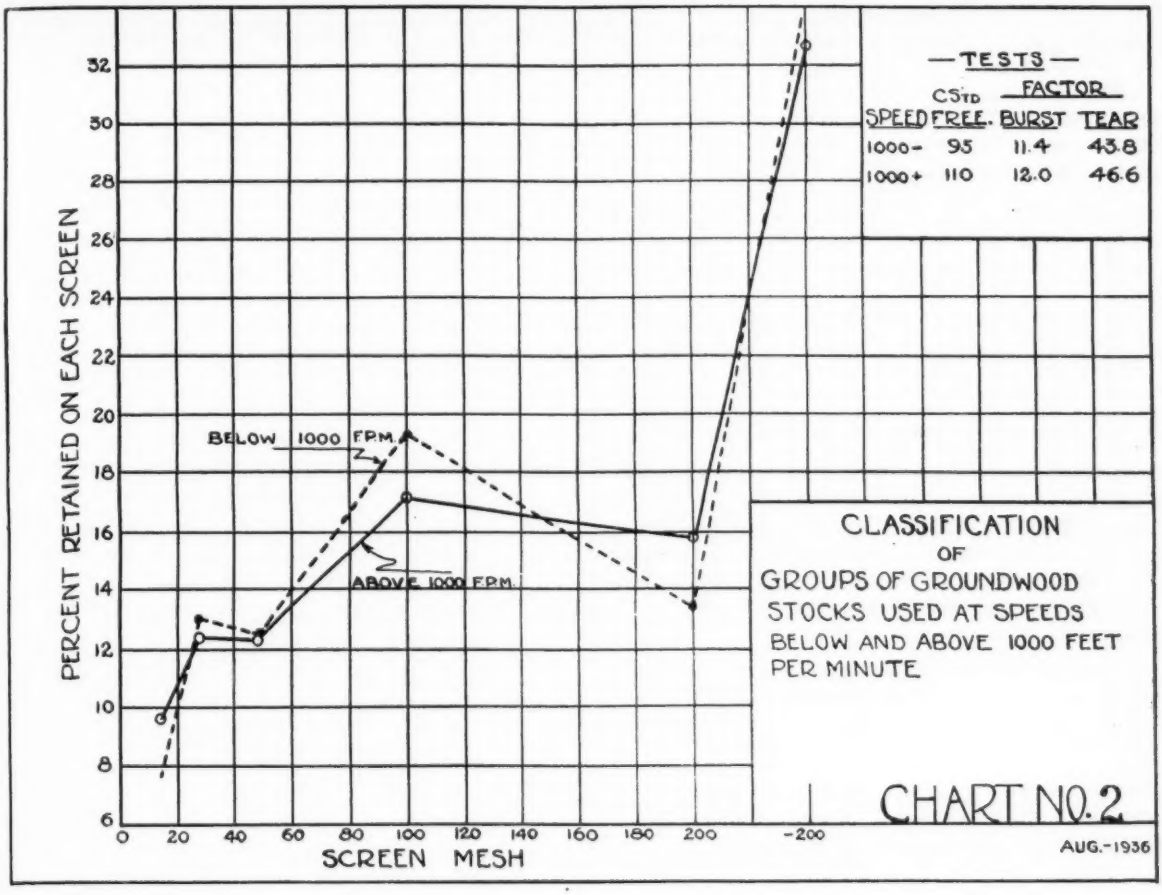
[1] Canadian International Paper Co., Gatineau, P. Q.

There are doubtless many others well equipped by experience and training to prepare a paper on this subject, so it is a double honor to appear before you today. The subject was discussed quite thoroughly by A. W. Simpson of our Company before the American Pulp and Paper Mill Superintendents' Association two years ago. In that paper he dealt with the pulp qualities required for high speed news and the methods that should be used in producing it. This paper is a start in answering the many requests of the Newsprint Committee of the Canadian Technical Section for a definition of the type of pulp that will be required for future extensions in machine speeds.

It would have been very acceptable to the Groundwood Committee if our conferes on the Newsprint Committee had seen fit to add something more in their request than the mere factor of machine speeds.

We are all in agreement that it is desirable to explore the type of stock required for manufacturing at higher




— TESTS —
CSTD FACTOR
SPEED FREE. BURST TEAR
1000- 95 11.4 43.8
1000+ 110 12.0 46.6
PERCENT RETAINED ON EACH SCREEN
BELOW 1000 FPM.
ABOVE 1000 FPM.
SCREEN MESH
CLASSIFICATION OF GROUPS OF GROUNDWOOD STOCKS USED AT SPEEDS BELOW AND ABOVE 1000 FEET PER MINUTE
CHART NO. 2
AUG.-1936

speeds while maintaining the present standards of quality in our final product—newsprint. It is very probable that a thorough study along these lines will assist the machine designers as well as the paper and pulp makers in meeting this problem.

At the same time we need to reach some agreement on what are the important qualities of stock and how they are transmitted by the machine into the finished sheet. For instance, under most circumstances freeness tests of the stocks at the regulator, or after mixing or from the pond will indicate quite well the drainage action of these stocks on the wire and suction boxes. But you all have doubtless heard of periods when stocks that appeared right by test did not act properly on the wire. What can be done to detect this improper action and counteract it? Then again the strength of mixed stocks or pond stocks generally indicates what strength can be expected in the finished paper but it occurs time and again that the ratio of paper strength to stock strength swings 5 to 10 per cent. This is a very serious matter when seemingly strong stocks will not result in adequate paper strength, for generally it means adding more sulphite for a time to recover the necessary strength in the sheet. That upsets the freeness and drainage conditions but most of all the cost of paper. There are other qualities that may get out of control at times, depending how close your sales specifications are, in respect to porosity, finish, bulk, etc. These remarks merely indicate that pulpmakers are fully conscious of the necessity for closer control of pulp making as soon as we can interpret these variables properly and provide tests with which to control them. These are problems that should be attacked from both ends, namely by the pulpmakers and the papermakers working as closely as possible together.

Notwithstanding any deficiencies that there may be in our testing technique we should make as much use as possible of our present data and try to project it into the requirements of the future.

Paper Machine Variables

For this purpose data has been assembled from various mills operating at different speeds in an attempt to find the trends of stock quality to machine speeds. Unfortunately it is not complete in all instances, but it is offered as a starting point or a basis for discussion. In Fig. 1. there have been plotted some data against machine speeds. At first glance Plot A would indicate that increased speed should be obtained with decreased sulphite. Of these points Nos. 10 and 11 refer to an earlier period of operation than the others and the change in sulphite content depends on machine differences and possibly differences in the type of paper required at that time. The difference between the groups of points 7 and 8, and points 1-2-3-9 is probably accounted for by differences in machine design, such as trim, wire length, suction box area, vacuum pump capacity, etc. It shows on the other hand that speeds approaching 1200 feet can be attained with less than 20 per cent sulphite on certain machines but not on others. It is also probable that machines will be run considerably above 1200 feet without any more sulphite and there are likely some here who can cite data of sulphite consumption at higher speeds.

Freeness Tests

One of the most usual tests for groundwood in freeness taken on the sliver screen stock and a number of mills are shown on Plot C. This indicates a fairly uniform rate of increase in sliver screen freeness for increasing speeds.

Freeness after the groundwood consistency regulator is not taken by so many mills, so that we have no such data for two of the lower speed examples.

But the remaining data on Plot D shows a fairly definite tendency for increasing the regulator freeness of the groundwood following increased speeds. Beyond the groundwood regulator there are not such pronounced trends for changes of speed, which is due to a number of reasons such as:—

1. Percentage of sulphite.
2. Hardness of sulphite.
3. Amount of recovered groundwood fines retained in the sulphite deckers.
4. Headbox consistencies.
5. Headbox temperatures.

The remaining Plots B, E and F pertain more to the paper machines than to the groundwood pulp. On the other hand they indicate conditions which prevent different machines or mills from using the same groundwood pulps for the same speeds. For instance compare Nos. 1 and 2 with No. 8 in a speed range near 1175 f.p.m. Nos. 1 and 2 use approximately 6 per cent more sulphite than No. 8 (Plot A). The groundwood freeness at the sliver screens is very nearly the same for all three Nos. (Plot C). At the regulator No. 8 groundwood is about 20 cc. higher in freeness than 1 and 2 (Plot D), while the mixed stock of No. 8 is 20 cc. lower than Nos. 1 and 2 due to the low sulphite content (Plot E). Again in Plot B note the headbox consistencies for these three units, Nos. 2 and 8, about equidistant from No. 1, with No. 2 consistency very low and No. 8 consistency every high.

These indicate a considerable difference in the drainage capacity of the various units, which must be taken into account in attempting to lay down the type of groundwood that will be suitable for each. Unfortunately we are not able at present to estimate these numerically so must find the necessary conditions by trial and error.

From the data on hand an effort has been made to tie in pond freeness, or pond freeness corrected to pond temperature, with speeds as in Plot F. This does not show any relation at all and it would be very interesting if anyone could volunteer any data on this point that would assist in clearing it up.

From the data presented above we can estimate in a general way that as speeds are increased, the freeness of sliver screen and regulator groundwood will have to be increased quite materially; such as 20 cc. per 100 feet for sliver screen stock and 10 cc. per 100 feet for regulator stock. These figures are necessarily very general and will require adjustment for each individual installation.

Fiber Classification Tests

Another approach to this question is by means of the classification test. Recently the Forest Products Laboratories conducted a series of tests on groundwood pulps from a number of Canadian mills for the Groundwood Committee of the Technical Section. From these there have been selected a number of newsprint mills running below 1000 feet per minute and a number running above that speed.

The average of the classifications of each group have been plotted on Fig. 2.

In the higher speed group there is a considerable increase in the amount retained on the 14-mesh screen, also the amounts on the following screens are more uniform than in the case of the average of the lower speed mills. The tests which are averaged and shown on the same chart are very significant. The faster machines are getting pulps that have higher freeness, burst and tear tests. It is difficult to interpret the test data in terms of the classification figures. Tear test is usually considered an indication of fiber length but there is only the 14-fraction and the 200-fraction higher in the pulp for the faster machines. There is very little difference in the minus 200-fraction of the two groups and the sum of the 200- and minus 200-fractions is actually higher in the group with the higher freeness test. We need a theory on explanation of the trend shown by these two sets of tests, for it will be necessary to continue increasing freeness and also these other tests in order to provide groundwood suitable for higher speeds.

It remains to summarise the qualities required in pulps for higher speeds and then to look into the methods that will be required to produce these pulps.

Summary

The data above indicates the following requirements for pulp to be used at higher speeds:—

1. *Freeness*—This should be increased.
2. *Strength*—Strength also must be increased in relation to the freeness. It would not be sufficient for instance to raise the freeness and allow the strength to follow its natural trend as indicated by the curves published by Patterson *(1)*. Allowing this to happen would result in weaker paper or an increase in sulphite consumption. It would also result in coarser paper, with poorer finish, more bulk and lower porosity or densometer test.

It is very difficult to lay down an exact program for bettering our pulp along these lines but there is considerable hope that we can attain it. It is, after all, only a continuation of the progress that has been made in decreasing the use of sulphite during the past few years. Those mills that have accumulated any considerable amount of freeness and strength testing data have probably found that they have made considerable gain in strength in relation to freeness during the period when they were applying these tests.

It is thought that the pulp for higher speeds will have to be longer but not coarser. In other words its ratio of length to diameter will have to be increased. It is doubtful whether it should be any more fibrillated for that will probably tend to hold down the freeness. It will probably require to be better graded as to the quantity in each fraction except white water or minus 200-fraction, although this phase of the question requires much more study.

What changes in our process will be necessary in order to make this type of pulp? At present it appears that it will have to be done by improving the details of the present process as there is no drastic improvement in sight. Stones will be picked more carefully and artificial stones may be changed slightly in grit or structure for different mills. Full use will have to be made of all auxiliary equipment such as load regulators, temperature controllers, etc. and finally, the men operating the equipment will be called on for closer and more accurate carrying out of their duties.

Acknowledgement

The data used in this paper is drawn from several sources and I want to thank all for their assistance, particularly the officials of the Canadian International Paper Co. for permission to publish this paper.

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A Study of the Effect of Hemicelluloses on the Beating and Strength of Pulps*

By Henry E. Obermanns[1]

Abstract

In this study, an effort has been made to show the relation of hemicelluloses to beating and to the strength of papers made from pulps containing various amounts of hemicelluloses.

Hemicelluloses were introduced into rag stock, in the first portion of the work, by overbleaching at elevated temperatures. It was found that, with an increase in degradation, the beating time to a desired freeness decreased rapidly and the strength characteristics were inferior to the original. Chemical tests confirmed the degradation by increased copper number and decreased viscosity. Ageing tests also showed the presence of degradation products.

Inasmuch as hemicelluloses are ordinarily present in wood pulps by virtue of not having been removed completely in the cooking process, and not essentially introduced because of a degradation process except in the specific case of overbleaching, it was attempted to introduce hemicelluloses into pulps mechanically to increase their content of these lower polymers. The addition of hemicelluloses mechanically has no effect upon the integrity of the original cellulose in the pulps, except as it may influence subsequent operations performed on the pulps. Xylan, in a fairly pure state, was added to rag stock mechanically to increase artificially the hemicellulose content. Using the same method of addition, the beta-cellulose fraction obtained from bleached sulphite pulp was added to sulphite and alpha pulps.

In all these cases in which the hemicellulosic material was added, the pulps hydrated more rapidly, showing that there is a direct relationship between added hemicellulose content and hydration. Strength characteristics increased appreciably, and in some cases passed a maximum value. The data seem to support the belief that this material which is added to the beater is beaten in as a filler and forms a film around and between the fibers, cementing the fibers together. Too thick a film apparently causes the brittleness shown by sheets containing larger amounts of hemicellulose. In the case of the tensile tests, the maximum appeared at a higher hemicellulose content, indicating that heavier films have appreciable tensile strength even though they are not so resistant to a flexing action. Accelerated ageing tests seemed to strengthen the hemicellulose film especially to direct tension.

As a result of these beating, strength, and chemical tests, the following conclusions have been drawn:

(1) There is a direct relation between added hemicellulose content and hydration. An increase in hemicellulose content decreases the time necessary to beat a pulp down to any desired freeness. This was shown to be true for pulps in which hemicelluloses were produced artificially by a process of degradation and also by the mechanical addition of various hemicellulosic fractions. From the results shown, it is also quite possible that hemicelluloses occurring naturally in the pulps have the same effect of speeding up the beating action.

(2) Strength, as represented by mullen, tear, tensile strength, and folds, increases to a certain maximum with an increase in hemicellulose content. A further increase in hemicellulose tends to decrease these values. The magnitude of the strength values varies with the kind of pulp, also, and with the particular test used as a criterion of strength.

(3) Ageing tests show that added hemicelluloses do not have a detrimental effect upon the stability of paper made from pulps containing them, especially as indicated by bursting strength, tearing strength, and folding endurance. In these tests, brittleness is a factor and all the sheets, both the original and those containing added hemicellulose, lose strength upon ageing. However, tensile strength is affected either favorably or not at all by ageing.

(4) Chemical tests indicate that added hemicelluloses are responsible, in part, for a great decrease in viscosity greater than may be explained by dilution, and that there is a definite relation between viscosity, copper number, and hemicellulose content, when an elevated copper number is caused by the hemicellulose present.

(5) Pulps which have been cooked in such a way as to produce well cooked pulps, while keeping hydrolysis at a minimum and consequently containing considerable amounts of hemicelluloses, should beat easily and have good strength characteristics. Also, by making the cook less drastic in order to prevent the unnecessary removal of too much hemicellulose, the resistant- or alphacellulose is not attacked to such a great extent and consequently the strength of the pulp should be greater on this account.

Hemicelluloses have been the subject of a great deal of research, but they have been treated, usually, only from the chemical viewpoint. Their value in paper making processes has been recognized to some extent, but as a rule only in a general manner. It is the object of this thesis to pick out one phase of the process, namely beating, and to attempt to throw some light on the effects of hemicelluloses on beating and on the resulting paper.

In 1891, Schulze *(1)* suggested the name hemicelluloses as a term embracing all of those cell wall components which are easily hydrolyzed to sugars by hot dilute mineral acids. He pointed out the fact that these same constituents are also soluble in hot dilute alkaline solutions, or in more concentrated cold caustic solutions. He considered the hemicelluloses as being formed as intermediate steps in the formation of cellulose in the plant, and as having the same structure as cellulose, differing only in degree of polymerization. The term hemicelluloses has remained, although it has been subdivided in a number of ways. Karrer *(2)* divided the field into four classes, namely hexosans, pentosans, hexosan-pentosans, and uronic acids, each of these headings having under it a number of specific hemicelluloses. Hägglund *(3)* divided the hemicelluloses into two classes, differentiating between those easily hydrolyzed and those difficultly hydrolyzed. Hawley and Norman *(4)* found that hemicelluloses fall into two main groups: Those incrusting materials not closely associated

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[1] Member TAPPI, Engineer, Hammermill Paper Company, Erie, Pa.

with cellulose, containing in almost all cases uronic acids, and those constituents intimately associated with cellulose and never containing uronic acids. Their criterion was the separation afforded by the Cross and Bevan cellulose method. To the first group they applied the term polyuronides, suggested by Candlin and Schryver *(5)*, while cellulosan was the suggested term to be applied to the second division.

In an article on the formation of beater slime, Schwalbe *(6)* states that this formation varies, depending upon the method of manufacture of the pulp. He found that a Mitscherlich pulp will form the slime more rapidly than will a quick cook sulphite, and he claimed that this is due to the fact that the former cook is milder and does not hydrolyze so much of the hemicellulose as does the latter. He showed that, in general, the purer the fiber, the more difficult is the formation of beater slime. As for the strength of the paper formed, he believed that, although the strength of the fiber itself is an important factor, it is not as essential to the strength as the formation of a good bond between the fibers.

Chintschin *(7)* showed that there is a relation between the sizing of paper and its hemicellulose content. Pentosans have a much higher adsorption capacity for size than does cellulose, and the resulting sizing of the pentosan bearing sheets is greater.

The belief that hemicelluloses play an important part in the ease of beating of pulps was shown by Wenzl and Congehl *(8)* and Richter *(9)*, who beat pulps in which the hemicellulose content was reduced by the mercerizing action of alkalies. These pulps were beaten with greater difficulty than the original stocks from which they were produced.

In a series of swelling experiments, utilizing the dilatometer carried out by Rowland and Young *(10)*, it was shown that there is an approximately linear relation between pentosans and hydration ability of pulps. In most cases it was possible to predict the swelling ability of a pulp, with the range of experimental error, merely from the pentosan content.

Jonas and Rieth *(11)* found that the addition of hemicelluloses hastens the beating action and markedly increases the strength of the resulting sheets. In Table I, are shown their results obtained by adding xylan and mannan to a pulp in the Jokro beating mill. Their results show that mannan is more instrumental in raising the strength of the sheets than is xylan. Also, an increase in the amount of hemicellulose added is followed by an additional increase in strength.

TABLE I

THE EFFECT OF HEMICELLULOSES ON THE BREAKING LENGTH OF PULPS CONTAINING ADDED XYLAN AND MANNAN

	Freeness at 20 minutes	Breaking Length in Meters
Original Pulp	610	6075
2.5 per cent Xylan added	590	6675
2.5 per cent Mannan added	580	7050
2.5 per cent Xylan plus 2.5 per cent Mannan added	500	7470

This evidence has mounted in the past few years, and various attempts have been made to retain the hemicelluloses in the pulps and still make a salable paper. Straw has been treated with dilute alkalies, both hot and cold, in a very mild action, notably by Rinman *(12)* and Wells *(13)*. Runkel *(14)* has suggested shortening the sulphite and soda cooks, in order to prevent excess hydrolysis of the hemicelluloses, and then defibering the pulp in a rod mill. Bleached spruce pulps of high pentosan content were obtained by this process. Beech pulps cooked by a shortened soda cook also had a higher pentosan content and greatly increased strength. It was found that such pulps are also easier to handle on the paper machine because of their increased wet strength. Tests on ageing showed little greater yellowing effect than with pulps cooked in the orthodox manner. This might be accounted for, to some extent, by the lesser degree of degradation of the alpha-cellulose itself.

Statement of the Problem

A large part of the pulp used for paper today is made from wood. The purpose of this problem is to throw some light on one of the constituents of these pulps, namely the hemicelluloses, and to study the characteristics induced by them. Of particular interest is their effect upon beating and upon the strength of the resulting papers.

Hemicelluloses constitute an appreciable portion of most wood pulps and can be varied between limits, depending upon the mode of preparation of the pulp. Knowing that these hemicelluloses produce certain effects, the pulp can be treated so as to contain larger or smaller amounts of hemicellulose in order to produce those effects.

Unfortunately for a study of this kind, the subject is somewhat intangible, and like most constituents of pulp, hemicellulose is bound fairly closely with cellulose. The line of demarcation between cellulose and hemicellulose, experimentally, is quite arbitrary. In this work, hemicellulose was considered as that material, excluding lignin, which was soluble in 6 per cent NaOH solution, maintained at the boiling point for one hour. This was believed to be a fairly satisfactory basis on which to carry out the experiments.

Two lines of attack suggested themselves, namely the production of hemicellulosic material in a pulp by means of a degradation process, and the mechanical addition of previously prepared hemicelluloses. The study of various pulps in which the amount of hemicellulose was changed by variation in the cooking process appeared to offer too many variables for direct correlation.

It was considered advisable to study first rag pulps, inasmuch as the base material would be almost pure cellulose. Also, the range of experimental result would be greater and offer more definite comparisons. Wood pulps were to be used later, since this is the first field to which the results would apply with possible commercial significance.

Increase in hemicellulose can be produced very easily by means of overbleaching, or bleaching at too high a temperature, and this was the method decided upon for the first phase of the problem. However, degradation obviously ensues, with the production of oxycellulose. Since all cooking processes are processes of degradation incidental to the removal of lignin, and some hydrocellulose and oxycellulose are formed, such a procedure might be significant. Most classifications of hemicelluloses include the degraded celluloses, which are only cellulose or lower carbohydrates possessing aldehydic or carboxylic groups or combinations of the two, and an error might be introduced by leaving them unconsidered.

Xylan is normally present in all wood pulps, and to a considerable extent in some of them. It can be prepared in a fairly pure state and with little contamination from other hemicelluloses. This was the hemicellulose considered for use as a material which could be added to the comparatively pure rag pulps. Addition of the hemicelluloses would change one variable only and effect a direct comparison. Naturally the addition of hemicelluloses to pulps by mechanical means will not duplicate the condition existing when these hemicelluloses occur naturally in the pulps. However, this added material, upon being agitated sufficiently vigorously, as in a beater, will be mixed with the pulp intimately enough to give a measurable effect. Moreover, it was desirable to gain the bond-

ing effect of the hemicellulose, if any, and the above conditions should make this possible.

When pulps are analyzed for their content of alpha-, beta-, and gamma-celluloses, that portion of the pulp which is soluble in the alkaline filtrate and insoluble when acidified is determined as beta-cellulose. This beta fraction contains a considerable portion of the hemicellulose and should be quite satisfactory for isolation and use as a composite hemicellulose. Addition of this fraction to pulps, being obtained from a bleached pulp to avoid the complication of appreciable amounts of lignin, should likewise give effects similar to those produced by naturally occurring mixtures of hemicelluloses. A specific mixture of certain hemicelluloses would hardly be more satisfactory, because of the variation in the proportions in different pulps. Addition of this beta fraction to sulphite and alpha pulps should give a good measure of the effect of hemicelluloses on these two types of pulps.

Experimental Procedures

I. Preparation of Stocks Used.

A. Stocks Obtained by Bleaching

These stocks were prepared by the method used by Lewis *(15)*.

To 2000 grams (oven-dry basis) of hydrosulphite cooked blue overall stock were added water and bleach liquor in amounts to give the desired concentration of 2 per cent chlorine and a consistency of 7 per cent. The charge was kept at 50 deg. C. in a hot water bath. Treatment was carried out for periods of ¼, 1, and 2½ hours. At the end of that time, stocks were treated with a solution of sodium thiosulphate and washed on a screen. The stocks were then squeezed, separated, and air-dried.

B. Stocks Prepared by the Addition of Hemicellulosic Material

1. Rag Stock.

The hemicellulose used in the beater runs on rag stock was xylan, which was prepared by the method of Salkowski *(16)* from soda pulp. This pulp was used as the source because of its high pentosan content. The method used was as follows:

1000 grams of soda pulp (oven-dry) were digested in an autoclave of 40 liters capacity, with 25 liters of 6 per cent NaOH solution for 1 hour at the boiling point. The pulp was filtered through a muslin bag filter, and to the filtrate were added 10 liters of the following solution:
350 grams $CuSO_4$
1730 grams Rochelle Salts
249.5 grams Commercial NaOH with water to 10 liters

This produced a gelatinous precipitate of a blue-green color, which was again filtered on the bag filter and washed with a small amount of water. The precipitate was then placed in a crock and treated with HCl to the disappearance of all blue color (HCl of 1.12 D plus an equal volume of water). To this was added 95 per cent ethyl alcohol in the quantity of 2 volumes (about 10 to 16 liters). The precipitate was filtered off on the bag filter and washed with weak alcohol and finally with distilled water. The xylan was kept for a short time in glass jars until used, so that disintegration and mixing with the stocks would be as thorough as possible. The xylan was later added to the beater as described under beating procedures.

The yield was approximately 100 grams, or 10 per cent, which is half the theoretical yield of about 20 per cent pentosan in the soda pulp.

2. Sulphite Pulps.

Two separate procedures were followed here. In the first case, 1000 grams of sulphite pulp were treated for 2½ hours at 0 deg. C. with 12.5 liters of 6 per cent NaOH. The stock was filtered on a bag filter and then placed in a screen, washed, acidified with acetic acid, and again washed. It was air-dried and used as a base stock to which to add hemicellulosic material.

The alkaline filtrate from this treatment was acidified with sulphuric acid and filtered on the bag filter. The precipitate, which was similar to the beta-cellulose precipitated in the volumetric gamma-cellulose determination, was washed with water and kept in the form of a paste until used in the beater.

In the second series of sulphite pulp tests, the base stock was the original sulphite pulp itself, to which was added, in varying amounts, some of the beta fraction isolated as above.

3. Alpha Pulp.

Alpha pulp was also subjected to the addition of some of the beta-cellulose fraction, obtained as previously noted, from sulphite pulp.

II. Strength Testing.

Two methods for strength testing of the pulps were used in this thesis. The first was employed in testing the rag stocks produced by drastic treatment with bleach liquor, while the second was employed in the case of those series of pulps to which had been added, by mechanical means, various amounts of hemicelluloses. The latter procedure was carried out in a small laboratory beater because of the convenience of the preparation of smaller amounts of hemicellulose for addition.

A. Strength Tests Made on Overbleached Rag Stocks.

In this procedure a laboratory beater of approximately 4 pounds of stock (oven-dry basis) capacity was used. After several trials, the conditions found to be satisfactory were as follows:

Charge: 1800 grams stock (oven-dry basis) plus 70,200 grams water, giving a consistency of 2.5 per cent.
Beater furnished—Roll 20 turns above bed plate.
Zero time—Roll 10 turns above bed plate. Add 643 cc. of 7 per cent size solution.
5 minutes—Roll 0 turns above bed plate. Add 90 grams alum.
30 minutes—Roll 1 turn below bed plate.
(This was done to be sure that the roll was riding on the bed plate).

Duplicate samples for freeness tests were taken every 30 minutes, beginning at Zero time. Samples sufficient for three hand sheets were also taken every 30 minutes, beginning at 60 minutes time. Beating was continued until two points, each half an hour apart, had been obtained below the arbitrarily chosen freeness of 500. The consistency used is much below that obtaining in a rag mill; but it was felt that the data obtained even under these conditions would be indicative of what might be expected in mill operation.

B. Strength Tests Made on Pulps to Which Hemicellulose Was Added in the Beater

The tests under this heading were made on all stocks to which hemicelluloses were added mechanically and also on the original stocks used in the same series.

For this purpose, a small 1 pound Valley laboratory beater was employed. Pressure between the bed plate and roll was varied by means of a lever arm connected to the bed plate and by weights applied to the end of the lever arm. The several conditions, differing only in respect to the weights used, are shown in the following table. Table II.

No size or alum was added except in one or two cases where it was considered desirable to obtain a comparison between the effects of sizing and added hemicellulosic material on the beating.

Hemicelluloses, where added, were put into the beater at zero time in the form of a slurry, due allowance being made for the weight of this added material in reducing the volume of water added to the beater.

TABLE II
WEIGHT CONDITIONS USED IN BEATER RUNS

	Pounds of Weight Used		
	Rag Pulps	Sulphite Pulps	Alpha Pulps
Stock furnished to the beater	0	0	0
Counterbalance weight	3	3	4
At zero time	5	5	5
At 5 minutes	5	5	5
At 10 minutes	..	5	..
Total net weight	10	15	10

Beater Charge: 360 grams stock (oven-dry basis) plus 25,000 cc. water.

Samples for freeness were withdrawn every 15 minutes. Samples for sheets were also withdrawn, two sheets being made at each point. When the freeness reached 350 (500 in the case of the rag runs), which was that arbitrarily chosen in this method in order that sufficient beating-in effect might be obtained, a larger sample was withdrawn which was sufficient for ten to twelve sheets. The beater runs were continued until one or two points below this freeness had been reached. In some cases, the freeness was so low that great difficulty was experienced in making sheets. The larger number of sheets made at a freeness of 350 was due to the desirability of oven and light ageing some of these sheets to determine the effect of the added materials upon the permanence characteristics of the resulting stocks.

The low consistency (1.42 per cent) was chosen because of the fact that circulation in the beater would otherwise have slowed up considerably after the withdrawal of a number of samples.

Freeness was determined by means of the Schopper-Riegler freeness tester, using a 2 gram sample. The freeness is in terms of cubic centimeters from the side arm overflow.

C. Sheet Making Procedure.

Sheets on all beater runs were made on the Williams sheet making apparatus. This consists of a direct driven motor agitator, employing a small bar paddle, a rectangular sheet mold which is 9¾ inches by 11¾ inches in size, a hydraulic press, and an electric dryer, thermostatically controlled. The sheet is held against the surface of the dryer by means of a tightly stretched canvas. The sheets were made in the following manner:

A portion of the diluted sample was placed in a battery jar and diluted to a convenient volume. It was stirred for 2 minutes on the agitator and then poured into the sheet mold, which had been previously filled to a certain mark, so that the addition of the suspension almost filled the mold. A perforated piece of fiber board was used for agitation in the mold and also for quieting the swirling of the suspension. The valve was opened and the sheet allowed to form. The wire, bearing the wet sheet, was removed from the mold, and onto the sheet were placed, in succession, a damp blotter, a dry blotter, and a felt. The whole was then placed in the press, and a pressure of 1 pound applied for 1 minute. The wire was then removed, and the sheet lifted off with the blotters and felt. Another felt was placed on the sheet, and the bundle placed in the press and raised to a pressure of 300 pounds. After 2 minutes, the sheet was turned over in the press and pressed again for 2 minutes. The sheet was then removed, separated from the blotters and felts, and dried for 3 minutes on each side on the drier. A slight alteration was made in this procedure just before commencing the beater runs on added hemicellulose bearing pulps. In place of turning the sheet in the press and drier, the sheet was pressed for 2 minutes only, on one side, and was dried for 6 minutes on one side.

The dry sheets were trimmed to an 8 by 10 inch size and placed in the humidity room. When the first runs were made, no humidity room was available, so a desiccator was used, employing potassium nitrite and giving a relative humidity of 66 per cent at 20 deg. C. The addition runs were made after proper humidity equipment had been provided, and the sheets from these runs were tested at a humidity of 65 per cent at 70 deg. F.

D. Physical Tests.

Basis weight was determined by means of the Thwing balance, which afforded a fairly sensitive method. The sheet weighed was 8 by 10 inches in size, and the weight was calculated to the weight in points of a ream, 17 x 22 — 500.

The tearing resistance of hand sheets was determined with the Elmendorf tear tester. Three or four thicknesses were torn, depending upon the strength of the sheets, to allow the instrument to operate in its most sensitive range, and the results calculated to a basis of 16 thicknesses. All tear results were converted to a common basis of a 24 pound sheet (17 x 22—500 basis), in order to make the results directly comparable. The tear is reported in grams.

The Schopper fold tester was used to determine the pliability or resistance of the sheets to folding. The results have been expressed as double folds on a strip, 15 mm. in width.

Tensile strength was measured on the Schopper tester. A strip 4 inches long and 15 mm. wide, was used and all results have been recorded in pounds on the basis of a sheet, 17 x 22 — 500.

Bursting strength was determined by means of the Mullen tester, the results being expressed as per cent mullen. The sheet weight here also, has been taken on the 17 x 22 — 500 writing basis.

E. Chemical Tests.

It was found advisable to run chemical tests on the sheets themselves, inasmuch as any hemicellulose material is beaten in as a filler and retention at various points would otherwise have to be ascertained. The remnants of the sheets used for physical testing and also the trimmings of the sheets from the point under consideration, were shredded in the Gosta-Hall disintegrator. The chemical tests were then made on these samples, thus assuring a close relationship between the chemical and physical tests.

Cuprammonium viscosity was determined by the TAPPI Standard Method T 206 m *(17)*.

The copper number procedure used was that of Schwalbe-Braidy *(18)*.

Pentosan content was determined by the method of the Forest Products Latoratory *(19)*.

Alpha-cellulose was determined by the TAPPI Standard Method T 203 m *(20)*. A modification was introduced, but only in that the alkaline filtrate was removed before acidifying the sample with acetic acid. This alkaline filtrate was split into two equal portions; the first was made up to 500 cc. with distilled water, and the second was acidified to methyl orange with 10 per cent sulphuric acid and then made up to 500 cc. with distilled water. These two solutions were used to determine the beta- plus gamma-cellulose and the gamma-cellulose, respectively, by the Forest Products method *(19)*, cognizance being taken of the fact that a larger sample must be pipetted out to conform to the same aliquot portions as in the Forest Products method. This procedure made it possible to run gravimetric alpha-cellulose and volmetric beta- and gamma-celluloses on the same sample.

This determination, as well as the pentosan determination, was the basis for ascertaining the content of hemicellulose in the stocks used, both before and after treating or adding hemicellulosic material.

Presentation of Data and Discussion of Results

I. Degradation of Rag Stock By Overbleaching To Produce Abnormal Hemicellulose Contents.

The stock used in this portion of the work was a lightly bleached blue overall stock, which had been cooked by a sodium hydrosulphite process *(21)*. This stock, which had an alpha-cellulose content of 97.7 per cent and a beta-cellulose content of 2.3 per cent, was high in viscosity and had a good color. The copper number of 0.125 shows that degradation in the cooking operation and initial bleaching was very slight. The stock was subjected to the overbleaching procedure already described, and was beaten in order to note the physical changes taking place in the pulp under this treatment.

Beating tests showed that the stocks had been altered considerably. The original rag stock was beaten to a freeness of 500 in 150 minutes, while the most degraded stock reached this same freeness in 84 minutes. The degree of degradation was followed closely by the ease of beating, indicating that the fibers were becoming more fragile and less resistant to mechanical action. A drastic treatment, such as bleaching at an elevated temperature, apparently caused a degradation which proceeded at the expense of the cellulose itself, breaking up the micelle into smaller units

Beating data on the overbleached rag stocks are presented in Table III.

TABLE III
BEATING DATA ON OVERBLEACHED RAG STOCKS

Time in Minutes	2.3 per cent Beta-Cellulose Freeness	7.4 per cent Beta-Cellulose Freeness	12.84 per cent Beta-Cellulose Freeness	17.5 per cent Beta-Cellulose Freeness
30	825	805	815	810
60	770	760	685	640
90	690	670	545	465
120	575	580	445	385
150	500	460	385	...
180	420	390	...	...
210	340	...	...	...

Table IV shows the respective tear and folds of the stocks at a freeness of 500. Both the tear and fold drop with an increase in beta-cellulose content. The greatest decrease in these characteristics is noted in the first degraded stocks, while greater degradation apparently causes a commensurately smaller decrease in strength.

TABLE IV
EFFECT OF BETA-CELLULOSE CONTENT ON TEAR AND FOLD OF OVERBLEACHED RAG STOCKS

Per cent Beta-Cellulose	Tear at Freeness of 500	Fold at Freeness of 500
2.3	142.	224
7.4	123.4	130
12.84	100.8	54
17.5	98.4	51

The tear of a sheet can be considered as measuring the strength of the fibers more than the strength of the bond between the fibers. In this case, there is probably a general degrading of the fibers, as well as a transformation to products which are measured as beta-cellulose. The alpha- or resistant-cellulose of the stock has probably undergone a change and become much weaker. This is shown to some extent by the folding tests. Since folding measures the brittleness of the fibers and sheets, it would be expected that the folding would decrease with an increase in the degradation.

The increase in beta-cellulose is probably due in large part to the formation of oxycellulose, which accompanies this type of degradation. In Table V, it is noted that the copper numbers of the stocks increase with an increase in beta-cellulose content. This marked increase in copper number reveals that considerable degradation has taken place. Such a degradation would exist to a lower degree in stocks which had been overbleached in commercial practice to obtain high whites, and also in rag pulps which had been in contact with bleach for too long a period. Stocks such as highly bleached overalls, in which the color has been obtained by bleach alone, would fall into the former class and exhibit easier beating characteristics, along with higher copper number and lower viscosity.

Viscosity measurements show the most striking change, dropping from a value of 253 centipoises for the original stock to 7.6 for the most highly degraded. The drop in viscosity indicates a general degradation of the cellulose.

The stocks, after oven ageing at 100 deg. C. for 72 hours, were poorer in chemical constants, as would naturally be expected. The beta-cellulose content increased noticeably, supporting the belief that the alpha-cellulose of the unaged stocks was in a semi-degraded condition and consequently susceptible to further degradation. This additional degradation was visible upon removing the samples from the oven, since they had noticeably yellowed, the color being most marked in the case of those stocks of the greatest degree of degradation.

Copper numbers remained approximately constant, but were less for the same beta-cellulose content value. Viscosities dropped decidedly upon ageing, giving evidence that the ageing degraded the stocks still further.

TABLE V
EFFECT OF BETA-CELLULOSE CONTENT AND AGEING ON CHEMICAL CHARACTERISTICS OF OVERBLEACHED RAG STOCKS

Unaged Stocks				Aged Stocks		
Per cent Beta-Cellulose	Per cent Pentosan	Copper Number	Viscosity Centipoises	Per cent Beta-Cellulose	Copper Number	Viscosity Centipoises
2.3	1.06	.125	253.	2.86	.130	67.2
7.4	1.09	1.15	14.8	8.08	1.28	9.6
12.84	1.14	2.24	10.7	13.83	2.16	6.3
17.5	1.23	3.16	7.6	22.1	3.16	5.4

Schwalbe *(6)* found that slime formation is aided by overcooking and overbleaching. If the bleaching is carried out too far, forming oxycellulose, or if the hydrolysis is too great, forming hydrocellulose, the slime formation ability of the pulps increases at the cost of the cellulose fiber.

The conclusion to be reached is that the fibers have been attacked and are in themselves weaker than in the original condition. There then arises the question of whether or not that portion of the pulp, measurable as beta-cellulose, and produced by the treatments, has a positive or negative effect upon the strength of these pulps. It is quite possible that any tendency of the beta-cellulose fraction to increase the strength could be offset by the great amount of degradation undergone by the cellulose. This question cannot be answered definitely from this series of experiments, and the second alternative, that of adding hemicelluloses to pulps by mechanical means without disturbing the other fibrous material, must be tried for its solution.

II. Addition of Xylan To Rag Stocks As A Means of Varying Their Hemicellulose Content.

In this portion of the problem, the same rag stock, containing 0.689 per cent pentosan, was used as in the degradation procedure of (I). However, in this case the original bleached blue overalls were not deliberately altered in any way except to add to the pulp, in the beater, a certain amount of xylan, prepared by the method given under Experimental Procedures. The xylan was added in paste form at zero time in the beater runs.

Table VI shows the results obtained in these beater runs.

It will be noted that here again, an increase in hemicellulose content is accompanied by a considerable drop in the beating time. Stocks starting out at approximately the same freeness, drop in freeness much more rapidly when the pentosan content is increased. These pentosan con-

TABLE VI
BEATING DATA ON RAG PULPS CONTAINING ADDED XYLAN

.689 Per cent Pentosan		3.63 Per cent Pentosan		6.48 Per cent Pentosan	
Time in Minutes	Freeness	Time in Minutes	Freeness	Time in Minutes	Freeness
45	820	45	825	45	730
60	770	60	770	60	600
75	695	75	700	70	540
90	625	90	590	80	460
105	550	105	490	110	190
115	485	135	255	140	100
145	280	165	180	...	...
175	205	...	...	...	...
205	155	...	...	...	...
240	115	...	...	...	...
270	100	...	...	...	...

tents are not those added to the beater but are those actually present in the sheet at the chosen freeness of 500. Variation in the amount of hemicellulose added to the beater probably has an effect upon the beating characteristics, but the change in strength of the sheets made from the pulps depends principally upon the amount of hemicellulose present in the particular sheet tested. In the case of one of the pulps, it was found that at a freeness of 500 the sheet contained 6.48 per cent pentosan, while at a freeness of 100 the sheet contained about 18 per cent pentosan. In later portions of the work, an attempt will be made to obtain a correlation between these two factors. However, the amount of pentosan in the sheet at the point chosen also gives an idea as to the amount in the beater.

This increase in the speed of beating is probably due to a great extent to the presence of a material in the form of hemicellulose which speeds up the circulation of the stock suspension in the beater in much the same manner as does size. Although it is quite improbable that the added hemicellulose exerts any chemical action upon the fiber, there is the possibility of an affinity between the hemicellulose and the cellulose of the fiber, which might be instrumental in causing an opening of the secondary valences. In this way, hydration without excess cutting action could be achieved and the resulting paper would be considerably stronger.

The strength characteristics of the sheets made from the pulps at a freeness of 500 are shown in Table VII. Certain sheets were also oven aged and light aged in order to obtain an indication as to their permanence qualities. It is surprising to note that the strength of the sheets containing added xylan even after a drastic ageing test is as great as the strength of the original stock.

TABLE VII
EFFECT OF PENTOSAN CONTENT AND AGEING ON THE STRENGTH OF RAG PULPS CONTAINING ADDED XYLAN

	.689 Per cent Pentosan	3.63 Per cent Pentosan	6.48 Per cent Pentosan
Tear at Freeness of 500:			
Unaged	168.	192.	176.
Oven Aged	157.9	168.3	159.7
Light Aged	158.8	167.7	165.7
Tensile Strength at Freeness of 500:			
Unaged	13.8	14.8	15.5
Oven Aged	15.21	16.91	18.12
Light Aged	16.05	16.10	17.88
Folds at Freeness of 500:			
Unaged	2750	3270	2250
Oven Aged	1454	2084	2474
Light Aged	1752	2067	1999

It will be noted that the tearing strength of the sheets increases to a certain point and then falls off as the amount of pentosan in the sheet increases. This is to be expected because of the fact that the more pentosan present, the more brittle material will there be in the sheet and consequently the more brittle will be the sheet itself. Both the xylan and the beta-cellulose fraction used in these studies were used in the pasty form, since they become very hard and horny when dried and are swelled again with difficulty. Attempts to incorporate such dried materials in sheets were not successful because of this drawback. Thus, with material of this nature in the sheets, brittleness is something which should follow, especially if the material is present in sufficient quantity to form a continuous film, upon being dried in the sheets. It was also considered necessary, for this reason, to allow the sheets to remain in the humidity desiccator or humidity room for at least a week before testing.

The same reason may be given for the decline in fold after a certain point had been reached in hemicellulose content. The fold test is very much more sensitive to brittleness, since it depends upon the flexing ability of the fibers and especially of the film or bond between the fibers, with which we are dealing in this case. Even in the case of sheets in which the hemicellulose is an integral part of the fibers, the drying of the sheet should make the fibers less resistant to the flexing action of the fold test.

Upon oven and light ageing, which produce effects similar in nature, a great diminution in tear and fold is noted. Apparently the sheets become more brittle during the ageing, but the sheets containing xylan still retain their strength advantage over the original sheets.

Upon examining the results of tensile tests made on the sheets, however, it is apparent that the tensile strength increases almost as a direct function of the pentosan content. Also, upon ageing, the tensile strength increases considerably over the unaged tensile strength, both for heat and light ageing. Here, again, it is a question of an increase in the completeness of the film on the one hand, and the hardening of the film by ageing on the other. In the case of tensile tests, which are a measure of the resistance of the sheet to direct tension and nothing more, the tensile strength should increase with an increase in strength of film or fibers, even though one or both may be brittle. Ageing apparently strengthens the film, even though fold tests show that it has become more brittle.

This would make such a sheet, containing a large amount of hemicellulosic material, better suited to almost all uses requiring either flexibility or merely tensile strength. Unfortunately, the sheets containing xylan did not retain their color upon ageing. The sheets yellowed, especially in the case of light ageing. In some sheets taken at a low freeness, in which the pentosan content was quite high, a great deal of yellowing was noted. The xylan added to the pulp and the degradation products originally present in the pulp are apparently unstable when subjected to accelerated ageing treatments.

TABLE VIII
EFFECT OF PENTOSAN CONTENT ON THE CHEMICAL CONSTANTS OF RAG PULPS CONTAINING ADDED XYLAN

Per Cent Pentosan	Per Cent Beta- plus Gamma-Cellulose	Copper Number	Viscosity Centipoises
.689	2.3	.125	204
3.63	6.03	.181	111
6.48	8.83	.192	107

The chemical constants show first of all that the beta- plus gamma-cellulose, determined volumetrically, is an approximately linear function when plotted against the pentosan content. This indicates that the pentosan is included in the beta- plus gamma-cellulose as determined analytically and that there is a direct relation between the two. In other words, the pentosan used in this series is a specific form of hemicellulose and can be legitimately used in a study of this kind.

An inspection of the curves depicting viscosity and copper number, show the same thing as before, namely, that the addition of pentosan increases the copper number and decreases the viscosity. The increase in copper number is probably due to the amount of reducing material present in the pentosan added. The decrease in viscosity is peculiar, since it is improbable that the presence of approximately 6.5 per cent of pentosan would dilute the cup-

rammonium suspension sufficiently to cause such a diminution. Something else has probably taken place, such as a catalytic action induced by this mildly active pentosan material, whose presence may have induced a partial destruction of the cellulose micelle.

III. Addition of the Beta-Cellulose Fraction To Purified Sulphite Pulp.

The pulp used for this series of beater runs, containing 11.29 per cent beta- plus gamma-cellulose, was prepared by the method given under Experimental Procedures. This method was used because of the desirability of removing the hemicellulose to a considerable extent and then adding the material, precipitated from the alkaline extract, back into the stock in the beater. It has been shown *(22)* that the extraction in the cold with dilute alkali removes a portion of the hemicellulosic material without affecting the chemical constants to any great degree. This filled the requirement of being able to produce an alpha type pulp. By returning the extracted material to the stock, an approximation of the original stock should be reached, at least insofar as chemical constants are concerned.

Graphical representation of the beating data shows the same general trend as before. The purified sulphite pulp has lost, to a great degree, its hydrating power. Microscopic examination of the fibers shows them to be shrunken and misshapen, much in the same manner as alpha pulps. Such pulps are known to swell with difficulty and then only after repeated beating action. This situation is remedied by the addition of hemicellulose, and a comparison of one of the curves of a stock containing about 17 per cent of beta- plus gamma-cellulose shows great similarity to the beating curve of the original sulphite pulp, which had a beta- plus gamma cellulose content of 17.78 per cent. True, the comparison is not exact, because of the fact that the gamma fraction present in the original pulp, and probably constituting the major portion of the most highly degraded material, was not precipitable and was therefore not added back to the purified stock.

Comparison of the strength characteristics of the pulps shows the same general trends as for rag pulps to which xylan has been added. Folds and mullen increase to a certain point and then drop off as the hemicellulose content becomes greater. Apparently, an excess of hemicellulose in the sheet produces a condition in which the artificial film has reached its maximum binding power between the fibers and subsequently becomes only thicker and more brittle. The loss in strength after a certain maximum point in the present case, however, is not as marked. The tear and tensile strength appear to rise with the amount of hemicellulose present in the sheet, and seem to have no maximum point within the limits of the amounts used in this series.

TABLE IX
BEATING DATA ON PURIFIED SULPHITE PULPS CONTAINING ADDED BETA-CELLULOSE FRACTION

11.29 Per cent Beta- plus Gamma-Cellulose		15.95 Per cent Beta- plus Gamma-Cellulose		17.06 Per cent Beta- plus Gamma-Cellulose	
Time in Minutes	Freeness	Time in Minutes	Freeness	Time in Minutes	Freeness
15	875	15	875	0	850
45	785	45	610	15	805
75	655	75	385	30	520
105	565	105	265	45	360
135	490	...	...	60	240
165	430	...	...	...	...
200	365	...	...	...	...
230	310	...	...	...	...

Upon ageing sheets in the oven, the same results are noted as in the case of the rag pulps containing xylan. The mullen, folds, and tear drop considerably in magnitude, while the tensile strength remains approximately the same. Here, again, the supposition that oven ageing could be a means of fusing or cementing together the film of added hemicellulose more completely, would apply.

The ageing tests showed that the beta-cellulose fraction was probably responsible for the yellowing of the sheets. This yellowing also seemed to progress with increases in hemicellulose content. Even the original purified sulphite yellowed to some extent, since it still contained an appreciable amount of hemicellulose.

TABLE X
EFFECT OF HEMICELLULOSE CONTENT AND AGEING ON THE STRENGTH OF PURIFIED SULPHITE PULPS CONTAINING ADDED BETA-CELLULOSE FRACTION

	11.29 Per cent Beta- plus Gamma-Cellulose	15.95 Per cent Beta- plus Gamma-Cellulose	17.06 Per cent Beta- plus Gamma-Cellulose
Per cent Mullen at Freeness of 350:			
Unaged	77.0	103.0	94.0
Aged	71.1	85.9	85.7
Tear at Freeness of 350:			
Unaged	29.0	48.5	60.0
Aged	22.4	31.0	37.7
Tensile Strength at Freeness of 350:			
Unaged	6.8	8.8	7.9
Aged	7.37	8.66	7.81
Folds at Freeness of 350:			
Unaged	3.6	14.2	12.5
Aged	2.2	4.0	6.0

In the case of these purified sulphite pulps, it will be noted that a large percentage of hemicellulose remains in the base pulp used for the series. From this arises the complication of having in the sheets some hemicellulose closely bound to the cellulose in the fiber, and some hemicellulose artificially added, which may be in the form of a film on the fiber and between the fibers. This may be the reason for the change in the shape of the strength curves.

TABLE XI
EFFECT OF HEMICELLULOSE CONTENT ON THE CHEMICAL CONSTANTS OF PURIFIED SULPHITE PULPS CONTAINING ADDED BETA-CELLULOSE FRACTION

Per Cent Beta- plus Gamma-Cellulose	Copper Number	Viscosity Centipoises
11.29	1.71	17.5
15.95	2.13	16.0
17.06	2.37	15.2

The chemical constants are again in agreement with the expected result, the copper number increasing with an increase in beta-cellulose fraction in the sheet and accompanied by a decrease in viscosity. It is quite evident, therefore, that the addition of the hemicellulose to the beater and its subsequent retention in the sheets is largely responsible for the chemical degradation as indicated by these analyses.

IV. Addition of the Beta-Cellulose Fraction To Sulphite Pulp.

It was considered advisable to use the same procedure on a series of beater runs based on sulphite pulp. Although a purifying treatment, such as that used in the preceding section to produce the base pulp for the beater runs, has supposedly but little effect upon the chemical constants, it has a marked effect upon the physical characteristics of the fibers. It would take more than mere restoration of the hemicelluloses to regain the original conditions, although it is quite possible that the addition of hemicellulose would so affect the fibers as to restore normal hydrating power. For this reason, it was decided to utilize a sulphite pulp of high hemicellulose content and to add to this some additional hemicellulosic material extracted from pulp identical with it.

Upon beating pulps thus obtained, the same characteristics stand out,—namely, increased hydrating ability upon an increase in added hemicellulosic material. The time of beating is considerably reduced, even in a pulp which, in its original condition, is very quick beating. The original pulp, containing 17.78 per cent of beta- plus gamma-cellulose, was beaten to a freeness of 350 in 45 minutes, while the same pulp, to which had been added enough beta-cellulose fraction to give it a beta- plus gamma-cellulose

content of 20.0 per cent at 350 freeness, was beaten down to the same freeness of 350 in 20 minutes, or less than half the time. Since the material added is neutral, there can hardly be a chemical action, but a colloidal action may take place, similar in mechanics to the addition of starch to the beater. A slight amount of the diminution in freeness is probably due to the clogging effect of the added material on the wire of the freeness tester, although experiments with unbeaten stocks showed that the addition of various amounts of the beta fraction to freeness samples of pulp had very little effect upon the drainage of the sample on the wire.

TABLE XII
BEATING DATA ON SULPHITE PULPS CONTAINING ADDED BETA-CELLULOSE FRACTION

17.78 Per cent Beta- plus Gamma-Cellulose		18.06 Per cent Beta- plus Gamma-Cellulose		20.0 Per cent Beta- plus Gamma-Cellulose	
Time in Minutes	Freeness	Time in Minutes	Freeness	Time in Minutes	Freeness
0	855	0	820	0	780
15	780	15	710	15	500
30	580	30	470	20	360
45	360	35	370	35	140
60	210	50	190	...	...

The effect of hemicellulose content of the sheet upon strength in this series is somewhat different again from the two preceding series. In this series, the initial hemicellulose content of the original sulphite pulp was rather high. In each case, as the original hemicellulose content of the pulp increased, so too did the tendency for the strength to drop off after a certain optimum hemicellulose content was reached. Within the limits of the amounts used in this series, no diminution in strength is noticeable. However, it is evident from the mullen and tear tests that the later increments of added material present in the sheet are less effective in increasing the strength than are the first portions, and eventually a saturation point will be reached.

TABLE XIII
EFFECT OF THE HEMICELLULOSE CONTENT ON THE STRENGTH OF SULPHITE PULPS CONTAINING ADDED BETA-CELLULOSE FRACTION

Per cent Beta- plus Gamma-Cellulose	Per cent Mullen at Freeness of 350	Tear at Freeness of 350	Folds at Freeness of 350
17.78	197.0	47.2	520
18.06	215.5	50.8	570
20.0	222.0	51.2	950

An examination of the amounts of beta-cellulose fraction added to the beater and the amounts found present in the sheets at a freeness of 350, shows that this function is approximately linear. Analysis on other sheets taken at other freenesses indicates that the retention would be proportionately greater for each pulp at a lower freeness. The hemicellulosic material added is beaten in as a filler, although it is quite possible that there is an electrical charge between the cellulose and the added material and that this affinity between the two would increase as the fibers are brushed out, exposing a larger surface.

TABLE XIV
RETENTION OF BETA-CELLULOSE FRACTION ADDED TO SULPHITE PULP AT A FREENESS OF 350

Per Cent Beta-Cellulose Fraction Added	Per Cent Beta- plus Gamma-Cellulose Present in Sheet
0.0	17.78
3.16	18.08
18.5	20.0

TABLE XV
EFFECT OF HEMICELLULOSES ON THE CHEMICAL CONSTANTS OF SULPHITE PULPS CONTAINING ADDED BETA-CELLULOSE FRACTION

Per Cent Beta- plus Gamma-Cellulose	Copper Number	Viscosity Centipoises
17.78	1.71	18.2
18.08	1.88	16.1
20.0	1.97	15.9

As will be seen from the preceding table, the chemical tests are somewhat different for this pulp than for the purified sulphite pulp, following more the trend of the strength curves of the present series. Apparently, larger quantities of hemicellulosic material added to the sulphite pulp have less proportionate effect upon the chemical constants, as in the case of strength characteristics, than do smaller amounts.

V. Addition of the Beta-Cellulose Fraction To Alpha Pulp.

Alpha pulps prepared by commercial methods offer a suitable material upon which to base a series of addition runs, since these pulps are produced with a view toward obtaining a high strength by removing degraded material. They are also hard beating pulps, in general, and offer a wide latitude in changes in beating time. An alpha pulp furnishes the extreme in low hemicellulose content in the wood pulp field. The alpha pulp used in this series had an original beta- plus gamma-cellulose content of 7.98 per cent. It is of interest to investigate the behavior of this type of pulp in order to ascertain whether or not the pulp can be made to approach the characteristics of sulphite pulp by replacing the hemicellulose material removed in the purification. An approximation of this condition can be attained by the addition of beta-cellulose fraction obtained from sulphite pulp.

The effect of hemicelluloses, as embodied in the beta-cellulose fraction added to the pulp, is the same in the case of the alpha pulp as with sulphite pulp. Quicker beating action is obtained by the addition of the hemicellulose. For example, a pulp which beats to a freeness of 350 in 117 minutes in the original state, beats to the same freeness in 79 minutes when containing 11.14 per cent of beta- plus gamma-cellulose, as in the extreme case in this series. From the sheets made at various times during the procedure, it is noted that the pulp, when containing added hemicellulose, quickly loses the "soft" feel and develops a rattle which the original alpha pulp does not have until later on in the beating procedure. Glassine formation is aided by the addition of the hemicellulose. Pulp bearing a considerable amount of added hemicellulose becomes "greasy" earlier in the beating process, and sheets made at a low freeness take on the glassine appearance.

TABLE XVI
BEATING DATA ON ALPHA PULPS CONTAINING ADDED BETA-CELLULOSE FRACTION

7.98 Per cent Beta- plus Gamma-Cellulose		9.15 Per cent Beta- plus Gamma-Cellulose		11.14 Per cent Beta- plus Gamma-Cellulose	
Time in Minutes	Freeness	Time in Minutes	Freeness	Time in Minutes	Freeness
0	840	0	850	0	845
15	830	15	820	15	805
60	670	45	695	45	630
90	500	100	355	80	340
115	360	130	210	110	180
147	225	...	...	...	...

An increase in strength with an increase in added hemicellulose content is again apparent in this series, although the mechanics of the beating-in effect are different than in the case of the sulphite pulp. Apparently, the original alpha pulp has been deprived to a great extent of its ability to hydrate readily, and this is aided by the addition of hemicellulosic material. The production of a complete film is more difficult than before, and therefore the strength, as shown by the mullen and tensile strength, increases slowly at first and then at a faster rate. There is probably also a maximum in these curves, but it must appear at a higher hemicellulose content than is shown here. The tearing strength is very similar to that of previous series, since it increases to a maximum and then falls off as the amount of hemicellulose increases beyond the optimum point.

TABLE XVII
EFFECT OF HEMICELLULOSES ON THE STRENGTH OF ALPHA PULPS CONTAINING ADDED BETA-CELLULOSE FRACTION

Per cent Beta- plus Gamma-Cellulose	Per cent Mullen at Freeness of 350	Tear at Freeness of 350	Tensile Strength at Freeness of 350
7.98	202	79.5	13.05
9.15	208	84.0	13.35
11.14	258	82.0	15.8

Retention of the added hemicelluloses in the sheet is also, in this case, almost a straight line function. The slight deviation from the straight line indicates the trend toward a state of saturation at some point, at which the sheet could no longer hold additional added material. This maximum point would depend upon the degree of beating.

TABLE XVIII
RETENTION OF BETA-CELLULOSE FRACTION ADDED TO ALPHA PULP AT A FREENESS OF 350

Per Cent Beta-Cellulose Fraction Added	Per Cent Béta- plus Gamma-Cellulose Present in Sheet
0.0	7.98
2.6	9.15
10.16	11.14

TABLE XIX
EFFECT OF HEMICELLULOSES ON THE CHEMICAL CONSTANTS OF ALPHA PULPS CONTAINING ADDED BETA-CELLULOSE FRACTION

Per Cent Beta- plus Gamma-Cellulose	Copper Number	Viscosity Centipoises
7.98	.284	44.7
9.15	.389	44.15
11.14	.518	42.35

Increases in copper number with increase in beta- plus gamma-cellulose content are again accompanied by corresponding decreases in viscosity. The decreases in this case, as well as in the case of the sulphite pulp, could be accounted for by the dilution effect of having a smaller percentage of cellulose present in the viscosity sample. The viscosity determination is sensitive enough to show such a dilution if carefully manipulated. The chemical tests show the increase in degraded material present in the sheets and it is quite probable, from the aging data on the previous series, that the permanence qualities as measured by chemical tests have been unfavorably affected by the addition of the beta-cellulose fraction.

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The Development of High Speed Paper Machines*

By W. T. Bennett[1]

(With the collaboration of B. Malkin[2] and J. H. M. Jones[3])

In considering the development of "high speed" paper machines, it is first of all necessary to define what we mean by high speed. When some one uses this phrase, most of us immediately think of the fastest operating speed of which we know, and then consider that that speed or one a few hundred feet per minute faster, is "high speed." It is thus apparent that the term simply indicates the maximum rate at which current operating ability allows us to co-relate the various functions of a paper machine so as to produce paper of competitive quality and cost. If we wish to determine when the first high speed machine was built, then, judged by this standard, we must go back at least seventy years, for the machines of 1867 were basically the same as our present machines. Even the first Fourdrinier machine, invented almost one hundred and forty years ago, was in principle essentially the same as our present wet ends. It was in 1799, at the mill of St. Leger Didot at Essonnes, France, that Nicolas Louis Robert made the first successful attempt to produce paper in an endless web, instead of making it a sheet at a time.

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[1] Resident Engineer, Canadian International Paper Co., Gatineau Division.
[2] Chief Engineer, Dominion Engineering Co., Ltd.
[3] Resident Engineer, Mersey Paper Company.

Robert's Paper Machine

Robert was granted a patent by the Government of France on a machine for making sheets of paper up to twelve feet in width and fifty feet long. A working model was constructed but the machine was not fully satisfactory. The principal operating feature of Robert's machine was an endless wire cloth which passed over a roll at each end. Pulp was beaten in a vat at one end and was thrown up by a revolving fan against a baffle plate which distributed the mixture on the slow moving wire cloth. Some water was drained off by gravity through the wire while a set of small squeezing rolls completed the preliminary dewatering. The receiving roll reeled up the wet sheet until a sufficient length was obtained, fifty feet being the practical limit. The rights to Robert's patent were subsequently purchased by Henry and Sealy Fourdrinier, wealthy stationers and paper manufacturers of London, England, who, with the assistance of Bryan Donkin, perfected the patent. Instead of a submerged vat and propellor arrangement for bringing the stock onto the wire, Donkin used a head box from which the stock flowed over a slide onto the wire. He also installed a set of moving deckles to improve the edges of the sheet, an upper felt on his couching device and a separate press section, which made use of an endless felt to carry

the paper. This extra press and felt considerably improved the firmness of the paper and increased production from the machine.

While this machine was successfully operated, it was more what we would consider the ancestor of the wet end of our present paper machines, rather than a complete machine, since a dryer section had not yet been conceived.

Improvements on the Paper Machine

During the next twenty years various improvements took place, such as the use of woollen jackets on couch rolls, the introduction of second presses, the application of suction underneath the wire and the invention of the dryer section. Finally, in 1867, a calender stack for improving the finish was added to the paper machine, thus completing the invention of the first "high speed" machine.

In 1867, many of the machines which were operating were 48 inches wide and only a few had wires up to 60 inches in width. Maximum operating speeds probably did not exceed 100 f.p.m. With these sizes and speeds, they were naturally what we would consider of very light construction and were not uncommonly built in the smaller machine shops of the United States. Since 1867, progress toward the building of wider and faster machines has been attained solely by refinement and improvement of details.

Fifty Years of Speed Increase

About 1886, Warren Curtis of the Hudson River Paper Company became dissatisfied with machines available at that time and submitted designs to several builders, which were a radical departure from anything previously tried. After much persuasion on the part of Mr. Curtis, the Pusey & Jones Company finally undertook to build two machines to his specifications which operated successfully at 250 f.p.m. These particular machines had a Fourdrinier wire 112 inches x 50 feet long and had fifteen driers, each 48 inches diameter, these being the first four foot dryers to be used. These machines were also the first to have a small dryer known as the baby dryer to carry the sheet from the second press to the dryer section.

Only a few machines were running during 1896 between 450 and 500 f.p.m. and one of the serious difficulties encountered with these "high speed" machines, was that of winding hard rolls, due to the fact that the winders then in use did not support the paper properly, allowing the wound roll to sag in the centre, with consequent tendency for the rolls to become imbedded in each other. The first two-drum winder was built and installed about 1898 and by its use the roll of paper being wound was supported throughout its whole length, and by the use of spreaders the edges of the rolls were separated, overcoming the difficulty of having the rolls run together.

During this period practically all paper machines were driven either by hydraulic turbines or steam engines through a lineshaft belted to core gears and pulleys. The first machine to be installed with a sectional electric drive was a 112-inch Bagley & Sewall machine of the Gould Paper Company, installed about 1906. This machine had electric motors direct connected to couch rolls, press rolls and other parts of the machine, with a hand operated rheostat control on each motor. This drive, while not a complete failure, fell far short of meeting the exacting requirements of such an application but was the forerunner of the sectional electric drive which we know today.

Millspaugh Suction Couch

Between 1908 and 1911 Millspaugh suction couch and press rolls were invented and applied to paper machines and although at this time they were still in the development stage, they have subsequently become standard equipment on all fast machines.

Development in fourdriniers continued to progress along the lines of wider and faster machines,—the major problem at the time being how best to obtain higher productions. Up to 1911, the fastest machine ran at about 700 f.p.m. and the widest machine was that of the Lake Superior Company, Sault Ste. Marie, Ontario, with a wire width of 196 inches. Possibly one of the reasons that there have been no basic changes in the process of paper making on the fourdrinier machine is that there seems to confront the operator, at all times, a seemingly unending supply of problems concerned with the perfection of small yet important details. Typical solutions of such problems were the invention of the Sheehan carrier rope system for dyers, in 1914, and the Pope system of compressed air jets for passing the paper between sections, in 1919, which are such essential parts of our present high speed machines.

Cutting Down Time for Changing Wires

Significant of machine development up to 1914 was the installation of a 158 inch Rice, Barton & Fales machine in the plant of the Great Northern Paper Company at Millinocket, Maine, which included many innovations. The design of this machine provided for a wire sloped 24 inch, table rolls which were carried on ball bearings, six foot diameter dryers, and a Pope uniform speed reel. The fourdrinier was built in sections, each carrying a group of table rolls, and could be pulled out on rails; this constituting one of the first attempts to cut down the time needed for changing wires.

Canadians Start Building Machines

The period between 1920 and 1931 witnessed an amazing growth of the newsprint industry in Canada which was characterized by an almost continuous building program and the installation of much wider and faster machines. At the beginning of this period the Dominion Engineering Company was organized and it is to the credit of the men in this organization, that their Company pioneered in the design and construction of many faster and wider machines than had ever previously been built. These machines naturally included the best practices existent at the time of their building as well as many improvements, and a record of the major installations therefore indicates the trend in the development of high speed machines.

The first outstanding installation during this period was that of two 166 inch machines built for the Laurentide Company of Grand Mere, Quebec. These were put into operation during 1921 and were the first paper machines to produce newsprint at a speed of over 1000 f.p.m. Although suction press rolls had previously been operated on slower and narrower machines, the success of the machines so equipped at Laurentide proved them as a necessary part of high speed machines. Laurentide's machines were equipped with suction first presses when installed and with second suction presses three years later. They were also provided with fourdriniers which were removable in sections. These machines were also equipped with sectional electric drives of the Harland type. The first successful application of the sectional electric paper machine drive was made by the Westinghouse Company two years earlier, in 1919, in the United States.

It was on these machines that Van de Carr developed the first nozzle type high speed slice.

In the years immediately preceding 1923, there had been considerable discussion in the industry as to whether it was desirable to build machines for moderate speed and wide widths or for high speed and moderate widths. The

answer to this question came in 1923 with the installation in the new Kenora Mill of the Backus Brooks Company, of a 234 inch machine which operated at over 1000 f.p.m. Included in the equipment on this machine was the first installation on a wide machine of a nozzle type slice and a suction first press.

Development of the Drive

Up to 1924, practically all machines had been built with the old conventional spur gear drier drive in which the gears were of slightly larger diameter than the driers. The first departure from this type of drive came with the introduction of the combination bevel gear and worm drive. During the years 1924 to 1927, there were ten machines installed having this type of drive, the most noteworthy of which, since they were the widest machines built up to that time, being the four 272 inch machines which went into operation at Gatineau during 1927 for the Canadian International Paper Company. These machines were designed for speeds up to 1200 f.p.m. and have since been successfully operated at these speeds. In the Gatineau worm dryer drives, all drive motors are direct connected into a line shaft which runs the full length of the drier section. Above each top dryer, there is a pair of bevel gears connecting from the line shaft to an inclined shaft. These inclined shafts are each connected through worms and worm wheels to one top and one bottom drier.

These machines were also equipped with Canadian General Electric sectional electric drives of the synchronous motor tie-in type. The master alternators for this electric drive were also direct connected into the line shaft on the drier section.

Another variation of the worm type drier drive was installed in the St. Lawrence Mill at Three Rivers. In this installation the line shaft is placed along a special floor below the level of the driers. It is interesting to note that the felt driers on this machine were independently driven in pairs by small motors through worm reductions.

Since 1927, several other types of drier drives have been designed and installed, such as the silent chain drive as built by Beloit, and the totally enclosed idler gear drives as built by Dominion. In an earlier application of a continuous silent chain drive to a drier section, the chain and sprockets are totally enclosed in oil tight casings mounted outside of the conventional drier frame and drier bearings. The return of the chain is in the basement.

In the latest application of the chain type drier drive, made on a 175 inch tissue machine, the chain and sprockets are enclosed within the drier frame. The drier bearings, which are of the anti-friction type, are mounted on the outside of the frame, beyond the chain sprockets. Both drier bearings and chain drives run in an oil bath served by a continuous oiling system. It should be noted that this drive makes possible an extremely open and accessible back side drier section, which it is claimed improves ventilation of the drier pockets.

One of the more interesting installations of the enclosed gears type of drive was installed in the St. Anne's Paper Company's mill at Beaupré. This drive had a separate motor connected to each pair of driers, one top and one bottom. Enclosed spur gearing connected each pair but there was no mechanical connection between the pairs of driers with the exception of the felt. The motors were not interlocked and were designed to allow the driers to run at the same surface speed as the felt. Each motor had a field control which could be adjusted to keep the felt tension uniform throughout the drier section.

Most of the later machines have a modification of this type of drier drive in which the driers are divided into groups containing from four to eight driers each. Such a drive is installed in the James MacLaren Company's mill at Masson, Quebec. The main drier gears are comparatively small and are connected through idlers mounted on anti-friction bearings; the whole being enclosed in an oil tight housing.

An important reference in connection with the history of developments during this period, is the installation of the first Minton drier for the drying of paper by vacuum. In 1926 one of the 156 inch machines at the Kenogami Mill of Price Bros. & Company, was converted to a Minton drier. The drier part of this machine contained twenty 60 inch diameter driers and was equipped with one top and one bottom felt. The machine ran at about 700 f.p.m. Since this time the same company has installed two more Minton machines, 234 inches in width, in the Riverbend Mill which will be inspected during this Summer Meeting. There are many advantages claimed for drying paper by vacuum, the chief of which are: a saving in length of machine, a reduction in steam consumption per pound of paper dried, an improvement in paper quality, and a saving in power and ventilation equipment required. Although these vacuum driers have been successfully operated, particularly when applied to Kraft and Board Mills, they have not found general acceptance by the paper industry.

In 1929, the Great Lakes Paper Company at Fort William, Ontario, installed the largest paper machine built up to that date. This was a 304 inch Bagley and Sewall machine designed for a speed of 1200 f.p.m. Although a number of machines have been installed in Canada since that date, no further four roll machines have yet been built in this country.

The last three machines to be installed during the Canadian expansion period ending in 1931, are of particular interest in our consideration of present high speeds, since they were designed for 1400 f.p.m. and have been operated near to this speed. At the Dalhousie Mill of the New Brunswick International Paper Company, two 226 inch Pusey & Jones machines went into operation and at Powell River, British Columbia, a 226 inch Dominion machine was started up. According to the best information available to the writer, the Powell River newsprint machine, which has been operated at a sustained speed of 1360 f.p.m., is probably the fastest machine operating today, while the two Rice, Barton & Fales machines of the Maine Seaboard Company at Bucksport, Maine, will probably run it a close second.

Comparing a 1900 Machine with One of 1930

An interesting comparison can be drawn between a machine built in 1900 and the Powell River machine built just thirty years later. The former was built by James Milne & Sons, Edinburgh, Scotland, for Holmens Bruks, Norkopping, Sweden and was designed for a maximum speed of 500 f.p.m. to make newsprint for the British market. It had a wire 162 inches x 60 feet, two sets of plain presses, twenty-four 54 inch driers, twelve roll calender stack, reel, Warren two-drum winder, and was driven from a steam engine through a mechanical drive.

The Powell River machine has a wire 226 inches x 90 feet, two suction presses and one smoothing press, fifty-two 60 inch driers, ten roll calender stack, a Pope reel and a two-drum winder. Considering the difference in age and speed, the general specifications of the two machines are remarkably similar. That there has been real progress, however, in improvement of detail, during the intervening thirty years between the building of the two machines, is evidenced by an examination of various parts of the later machine. All rolls, particularly table rolls, are much larger

and are statically and dynamically balanced. The suction boxes are equipped with oscillating mechanisms. Anti-friction bearings are used practically throughout the machine. Deckle straps have been eliminated and the couch and two presses are all of the suction type. Flexible press roll doctors, compressed air leading devices, Sheehan rope carrier in the driers, scientific drying and ventilating systems, electric and hydraulic lifting devices, all are the typical devices of our present high speed machines.

The slice used deserves special mention since it is a distinct variation from the usual nozzle type of slice. It was invented by R. Bell-Irving and P. Sandwell of the Powell River Company and in combination with the head box is capable of vertical, lateral and angular adjustments in relation to the breast roll and wire. Thus the issuing jet can be made to strike the wire at the best possible operating angle and level.

This slice is more truly a long, flat, horizontal, hydraulic nozzle than our usual slice. The plates forming its lower side are fixed to the adjustable head box framing while the sloping part of the top plate is capable of adjustment for governing the weight of the sheet. In addition, the whole mechanism of this top sloping part is hinged, so that it may be swung up for cleaning without disturbing the adjustments. The flow evener blades are mounted inside of the nozzle and it is an interesting fact that until a thorough streamlining job was done on these blades, particularly on the trailing edge, operation at high speed with this nozzle was not possible.

The Removable Fourdrinier

Another notable advance in design which is included in the equipment of this machine is the removable fourdrinier. It has previously been mentioned in connection with the installation of a 158 inch machine for the Great Northern Paper Company, in 1914, that the first attempt to cut down the time for changing wires consisted of building the fourdrinier in sections. About ten years later, The Beloit Iron Works introduced their design for complete removal of the entire fourdrinier table from the breast roll to the couch. Other builders quickly adopted this method, along with numerous variations of it, so that today there are many excellent designs available to suit both new and existing machines. The fourdrinier at Powell River, is of the Dominion design; the main difference between it and the Beloit design being that in the Beloit type the fourdrinier rolls out on stationary tracks while in the Dominion type the tracks are part of the Fourdrinier and the rollers are mounted in stationary stands on the base-plates and the floor.

The final item of particular interest at Powell River is the means provided for relieving the nip pressures on the calender stack. In order to avoid the excessive nip pressure encountered between the lower rolls of a high speed attack, air operated lifting cylinders are mounted on each end of the top of the stack, which are connected through suitable lifting rods, yokes, and special bearings to the ends of each of two calender rolls. When pressure is being exerted by the lifting cylinders, nip pressure is reduced in the nips of the lower five rolls, the nip pressure between the intermediate and bottom rolls being reduced from 672 pounds per linear inch to 431 pounds per linear inch. I understand that this device is not at present in use, due to changed requirements of the paper being made, but can be satisfactorily operated at high speed.

This brings us to the end of the expansion period of 1920 to 1931, but, before passing on, changes in certain characteristics in the designs of machines should be noted. As higher speeds were obtained the shaking fourdrinier went out of existence on newsprint machines. There was a gradual increase in the length of the wire as speeds increased and a length of up to one hundred feet was reached.

The downward pitching of the wire from the breast roll to the couch roll came to be considered an essential for high speed, although today there seems to be considerable doubt in the minds of operators as to whether this sloped fourdrinier is applicable in all cases and many machines are running at speeds in excess of one thousand feet with level wires. Reversing third presses were common until speeds became too great for safe operation, when most machines abandoned reversing presses entirely and converted their third presses into smoothing presses. Four foot driers passed out of the picture and machines were built with either five foot or six foot diameter driers. Aprons and deckle straps were abolished and the use of nozzle slices for projecting the stream of stock from the head box onto the wire, came into vogue.

Outstanding Improvements by 1931

Outstanding improvements which had come into being by 1931 and which contributed greatly to our ability to attain higher speeds, were the suction couch and press, air handling devices and the rope carrier for dryers, the nozzle type slice, rotary vacuum pumps, revolving screens, and the drum type reel.

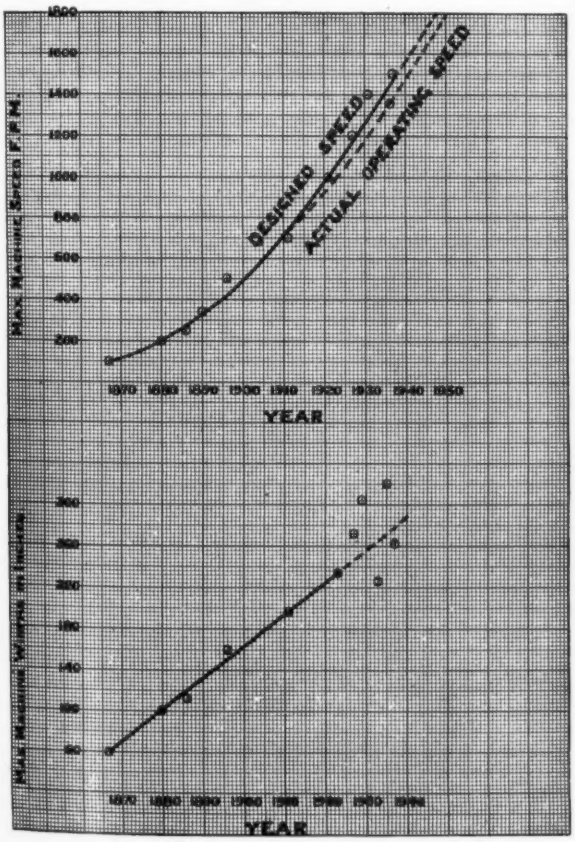
The World's Widest Machine

The years between 1931 and 1935 were characterized by decreasing markets for paper and demands on the part of the publishers for improved quality. With considerable excess productive capacity in the industry, no new machines were installed in this country, and with special emphasis placed on quality, there was little incentive to the individual mills to increase speed of existing equipment. However, one notable new installation was made; namely, what is at present the widest paper machine in the world, the 320 inch machine built by Walmsleys (Bury) Ltd. for Edward Lloyd & Company Limited at their Kemsley Mill, Sittingbourne, Kent, England. Due to the designed speed of 1400 f.p.m. and the unusual width of this machine, sizes of various parts, particularly rolls, are out of the ordinary. The breast roll is 34 inch diameter and is built from a steel tube, rubber-covered. Table rolls, which are made of hard copper, are 15 inch diameter. The suction couch roll, of the Beloit design, is 44 inches in diameter and is prepared for cantilevering. There are five double suction boxes under the wire built of copper plate steel plate and designed with two compartments for stiffness. Each suction box is provided with a Drysdale suction pump. Two wire stretchers are provided. Their dandy roll, with a diameter of only 24 inches for a 320 inch wire, seems out of proportion with the rest of the roll sizes used. There are only two presses on the machine. These are 44 inch diameter, of Beloit design, and are rubber covered. The dryer part contains sixty dryers, 60 inches in diameter, mounted on SKF bearings and arranged in three independent sections having no idlers to connect the sections. The drier drive is of the totally enclosed spur gear type, with 10 inch face gears of two diameter pitch. The machine is equipped with a 96 inch Voith slice arranged for horizontal, vertical, and angular adjustment in relation to the breast roll, the joint between the slice and flow box being made with a rubber diaphragm. As is usual in British newsprint mills, the machine is equipped with both a calender and a super-calender, the latter having its top and bottom rolls mounted on "Michell" type bearings. A sectional electric a.c. motor drive and a Voith-Grewin broke reclaiming system complete the more important parts of this outstanding machine.

Machines to Run at 1500 f.p.m.

Since the early part of 1935, the paper industry and particularly the newsprint industry has been able to assume a more optimistic attitude and, due to expanding markets, has been able, once again, to find appropriations for improving existing equipment in order to attain higher speeds and greater productions, and for installing new equipment. In this latter classification, such information as is available to date on the paper machines to be installed by the Ontario Paper Company at Comeau Bay, Que. may be of interest as indicating the most recent trend in high speed machine development. There will be two machines with wires 262 inches wide by 100 feet long designed for speeds up to 1500 f.p.m. maximum. They will have eight suction boxes and 44 inch diameter couch rolls equipped with double suction boxes, so that provisions can later be made, if desired, to run at high couch vacuum. In addition, a presser roll will be mounted on each couch. The presses will consist of two presses of the rubber covered suction roll type and a two roll smoothing press in which the bottom roll is steel to cut down deflection. The dryer sections will have forty-eight 60 inch dryers and ten 60 inch felt dryers arranged for four top and four bottom felts. Each of the first top and bottom felts will have two felt driers, while the remaining felts will have one felt dryer each. The drier drives, which will be of the enclosed idler gear type, will be of interest since they will be made with single helical gears throughout. The disclosure of Ontario Paper Company's decision with degard to further details will be awaited with interest.

It has been mentioned that present high speeds of newsprint are between 1200 and 1400 f.p.m. If a curve for maximum designed speed in feet per minute be plotted against the year in which the machines commenced operation, using the speeds and dates of installations made during the past seventy years which have been noted in this paper, there is a surprisingly uniform rate of increase in maximum designed and operating speeds. For a period of over fifty years, a uniform rate of increase in machine widths, plotted in the same way, seems to hold true, also, but widths of recent installations do not appear to tie-in at all. Returning to the speed curve, the extension of the curve beyond the year 1937 indicates that by 1941 we should be planning new equipment or speeds in excess of 1600 f.p.m. and some mills will be operating at 1500 f.p.m. Speeds of 1800 to 2000 f.p.m. appear to be well worthy of study and consideration in the not too distant future.



So far, this paper has dealt chiefly with the design and installation of new paper machines as indicating, over a period of years, the major developments which have taken place. Now, let us examine some of the alterations which have been recently made to existing equipment to increase speed and some of our present limitations. It is not within the scope of this paper to do more than outline these limitations in a general way, but it is hoped that they may be considered in greater detail in later meetings of the Technical Sections.

Present and Future Developments

Considerable study has been given to the problem of head box design, which for high speeds is becoming simpler and with better streamline characteristics. Many machines have been re-equipped with head boxes which provide a dam in the outlet from the Bird screens to maintain the level of the stock coming from the screens at or near the screen centerline, thus increasing screen capacity. Head boxes are often of the single pass type, with a single baffle for controlling the flow. Various types of flow eveners, for straightening out eddy currents in the stock before it issues from the slice nozzle have been tried, but the most successful appears to consist of a series of fairly thin plates, spaced from 1 to 1½ inches on centres and located from ten to eighteen inches back of the slice orifice. At high speeds, if the flow evener plates are placed too close to the slice orifice, they will cause bubble formation and marking of the sheet. Streamlining the trailing edge of the plates has proved helpful in this respect. Most high speed slices are of the modified Van de Carr type with an adjustable, flexible, upper lip. This upper lip, which was originally made of cast bronze, has also been successfully modified by making it of flexible stainless steel. With the old bronze lip it is necessary to remove the slice and polish it at periods of from four to eight weeks, in order to maintain smooth flow characteristics. In some cases, both the upper and lower slice lips have been chromium plated with considerable success, the smooth chromium plating contributing to a smooth even flow from the slice orifice.

At high speeds it is essential that all table rolls be in dynamic balance to avoid whipping and vibration with consequent adverse influences on sheet formation. Brass tube rolls are being largely replaced with rubber covered steel tubes, which can be made much stronger and more stable for the same diameter. The use of rubber covered rolls, with, in some cases, the addition of baffles between each pair of table rolls, has resulted in improved formation on the wire.

End-of-grain covers for suction boxes are finding general acceptance at high speeds. They maintain a smooth surface in contact with the wire for much longer periods than other materials and exert appreciably less friction drag on the wire. Increased vacuum in the suction boxes has

been tried out and is found to have a double effect on the sheet. Several mills, which have always measured the vacuum on their boxes by a gauge on their suction header —which in one case showed from 12 to 14 inches—were surprised to find that the effective vacuum in their wet boxes was actually between zero and 1 inch of mercury. To overcome this condition and to operate with an actual effective vacuum of 6 to 8 inches, the area of suction connections to the boxes has been increased, with, in some cases, a re-design of the suction header and the addition of more flat box water handling equipment. The additional flat box capacity obtained by these changes has been very important, since it allows the machine operators to run a lower consistency stock in their head boxes and to obtain better formation on the wire by so doing. During recent tests taken at one mill, suction box header vacuums were increased from a normal of 8½ to 12¾ inches—other conditions being held the same. With this increased vacuum a considerable improvement was noted in operating conditions which took the form of an 11 per cent increase in Mullen test, 16 per cent increase in tensile, and a harder sheet, as evidenced by a 10 per cent reduction in stretch of the paper travelling between the couch and the stack. At the same time the power required to drive the couch increased 11 per cent, which would of course indicate a reduction in wire life. It has yet to be determined in practical operation, whether or not the apparent gains in sheet quality will more than offset the increased wire wear occasioned by operating at high suction box vacuum and some practical solution to the problem of cutting down "drag" between the wire and the suction boxes is needed. Similar improvements to operating conditions can be made by increasing the vacuum carried on the suction couch and one mill has equipment on order, at the present time, which will enable them to operate with a couch vacuum up to 26 inches of mercury. At the present writing around 18 to 20 inches is the normal vacuum carried.

Double Couch Suction Box

Increasing the vacuum on the couch, by hardening up the sheet, appears to have the same desirable characteristics in a somewhat lesser degree than an increase in flat box vacuum, but unlike the latter should contribute to increased rather than decreased wire life, especially if there is any tendency for the wire to slip on the couch. A fairly recent development of particular value for use with high couch vacuum is the double couch suction box. This is similar to the usual suction box except that it is nearly twice as wide and has two entirely separate compartments. In action, however, there is a marked difference in the vacuum pump capacity required in order to attain higher vacuum. It has been reported from tests, that a very large percentage of the vacuum pump capacity is used in sealing the sheet and in evacuating the holes in the couch and that only a small percentage is drawing through the sheet. If, then, the first compartment of the double box is connected to one vacuum pump and the second to a separate one, the first one can operate at good efficiency with large volume and moderate vacuum, while the second pump, operating at high vacuum, need have only comparatively small capacity. Considerable reduction in overall power requirements is claimed for this hook-up.

A similar gain in operating conditions can also be made by the installation of soft rubber covered riding rolls on the top of the couch. Recent installations have been made using a comparatively light weight steel tube covered with 1½ inches of 200 Pusey and Jones Plastometer rubber, the roll being carried in hydraulically operated, shock absorbing lifting mechanisms at each end of the couch. The use of these riding rolls, or "presser rolls" as they are called, has normally increased the vacuum in the couch suction box on the order of about 1 inch and at the same time has given a firmer, denser sheet which has less tendency to break at the wet end. It has also been effective in reducing breaks due to lumps.

Dandy rolls are in almost universal use and since they are a comparatively recent development for high speed, wide machines, have caused some operating difficulties due to the rolls becoming unbalanced after being in service a year or so. These operating difficulties have apparently been overcome in one mill, which on a 272 inch machine uses a dandy roll of open end trunnion construction, 27 inches in diameter, which has been developed by Johnson Wire Works. This dandy is equipped with stainless steel running races and trunnions, extra strong diagonal bracing throughout, and is mounted on a shock absorbing type of spring mounting.

Life of Wire Felts Nearly Doubled

To obtain better pressing conditions rubber covered suction rolls with a covering approximately 1 inch thick and having a density of 30 to 40 P & J Plastometer, are being installed. In practically all cases these rubber covered press rolls have nearly doubled the life of wet felts over that previously obtained, when using metal suction shells. Within my experience, it is possible to obtain slightly more uniform moisture content across the width of the sheet being pressed but the average water removal from the presses is not greater than with metal suction rolls. Vacuums on suction presses at the present time usually run somewhere in the neighborhood of 17 inches and plans are under way to operate with vacuums up to 26 inches, to determine if, by this means, a dryer sheet can be obtained at high speed before entering the dryer section. Evenness of drying has been improved by the installation of better drainage systems for the dryers. In Canada, where large quantities of steam generated from electric boilers are being used for drying, the problem of removal of gas generated and entrained with the steam, becomes an important function of the drainage system. These gases have the tendency to collect in the dryers and to cause uneven drying of the sheet. The only solution to the problem of how to evacuate them, appears to be to supply adequate forced circulation through the majority of driers on the machine.

To anyone who has tried to keep the steam joints on dryers in really good condition and to maintain syphon pipes with uniform clearance between the end of the syphons and the driers, the development of a new type of steam joint will be of interest. The particular joint shown has its rigid frame solidly bolted to the housing of the anti-friction bearing on which this dryer is mounted. The joint can be equally well adapted to sleeve type bearings and to various forms of dryer drive. This rigid frame contains cored passages to which the steam supply and condensate pipes are connected. It also supports the syphon pipe, so that in effect, the syphon pipe is rigidly connected to the frame of the machine, and is not dependent for alignment on a flexible joint. Misalignment of the end of the dryer journal due to temperature changes is taken up by a spherical washer made of anti-friction bronze with lubricating inserts and by a spring loaded stainless steel diaphragm. In operation, this joint appears to require no maintenance whatever and does not leak with changes in steam pressure.

With increased speed, ventilation and drying may become a problem but one which can be comparatively inexpensively solved by the installation of additional fan capacity. On machines where the top deck of driers is close to the lower deck, in other words, if the machine has

short draws, the collection of vapor in the drier pockets may cause uneven drying. To meet this condition the Ross-Grewin system of forced circulation through the drier pockets has been developed and successfully applied. On machines with along draw, ventilation as an important contributing factor to uneven drying, does not exist. In maintaining the average uniform moisture content of the whole sheet, the use of drier temperature controllers has found general acceptance. The simpler forms of air-operated temperature controllers, as made by several of the instrument companies, have proven entirely satisfactory for controlling average sheet moisture. As compared with some of the older systems used, they also actually contribute to increased production due to reduction of time lost in getting the paper over the dryers after a wet end break. The use of additional felt driers for evening out the drying has been successful in some cases and disappointing in others. Felt driers will be discussed later in connection with machine capacity. A system has been developed and the writer understands that it is in use in one mill, for increasing the average moisture content of the finished sheet by passing it through a bath of humid air, between the drier section and the calender stack. Average sheet moistures up to 10 per cent at high speeds, are reported with this system, but since it is not readily adaptable to existing machines it has not found wide acceptance. Water atomizing spray nozzles to control sheet moisture have been experimented with. It appeared from these experiments that it is possible to effect sheet moisture by spraying the sheet with water either before the stack or before the dryers, but that mechanical difficulties make this application impractical.

Every paper maker knows that there are many places where lumps can form and to overcome the tendency of the stock to "lump" resort has been had to streamlining of head boxes and their construction of either solid metal or with a lining which will not collect stock or slime. The favoured metal for this purpose today is sheet copper. The prevention of slime formation is largely a problem for the chemist and bacteriologist, but the use of copper for piping, head box linings, flow eveners, etc., is of considerable assistance.

Electric Drives

Most high speed paper machines are equipped with electric drives, as made by Harland, General Electric and Westinghouse, which give essential control of the draw between various sections of the machines. Provided the equipment is properly maintained there is very little difficulty due to breaks caused by drives.

All the different combined parts of the paper machine have definite limitations in their capacity when operating at high speeds, but most of these limitations are capable of an increase with reasonable cost. Chromium plated Bird screen plates have been installed, primarily to maintain good screening conditions, but at the same time to show increased handling capacity over bronze screen plates, especially if the bronze screen plates are not undercut. A new type of Bird screen has been developed by Ingersoll-Rand in which the flow of stock takes place from the end of the cylinder rather than from head boxes on each side of the cylinder, which is claimed to have superior operating characteristics and greater capacity.

It is necessary to increase pond height as machine speed is increased. In some cases it may be necessary to purchase and install new slices but in the majority of cases an extension can be built on the existing slice if it is the Van de Carr type. If speed is limited by drying capacity, this capacity may be increased by the installation of intervening felt dryers. In such an arrangement the dryer felt is carried around several paper driers and then over a felt dryer, then onto a few more paper dryers and over a felt dryer again. It seems theoretically possible to install as many as one felt dryer for every two paper driers and it has been found that these felt dryers are nearly as effective in helping to dry the sheet as the paper dryers themselves. These felt dryers are normally installed either on top of the machine or in the pit or both, and since they are mounted on anti-friction bearings can be driven by the felt without any external drive.

Higher Speeds Increase Problem

As we go to higher speeds, the problem of how to get the stock onto the wire becomes more and more serious. With the nozzle type slice, the pond height required for speeds of 1500 to 2000 f.p.m. is in the order of 100 to 170 inches. Sloping the wire has a tendency to increase these head requirements, but a very definite limit on the degree of slope is set by slipping or rolling of the stock on the wire. At present, our only means of increasing pond height consists of lowering head box consistency or decreasing the slice opening. We are limited in the amount which we can decrease pond consistency by our capacity for extracting the additional water from the sheet before it leaves the couch. As we decrease the slice opening, the least imperfections in the adjustment of the lip or in the flow of stock to the orifice become very marked in their effect on sheet formation and the sheet is apt to become streaked and "wild." Further study is therefore needed on the structural and hydraulic problems of laying the stock on the wire and for heads over 100 inches, consideration may have to be given to the use of pressure type slices or some other entirely different development.

Obtaining Adequate Drainage

With existing machines, operation at high speeds usually involves difficulty in obtaining adequate drainage from the wire. We can not increase our pond consistency in order to handle less water, without adversely affecting sheet formation both on the wire and due to the necessity of running a smaller slice opening. If we decrease pond consistency, we must be able to handle the additional water by means of table rolls, suction boxes, or couch. The water removal characteristics of table rolls at high speed need further investigation. At present, the rate of removal seems to depend on wire speed and to be practically independent of rotative speed. With high wire speeds, too rapid removal of water by the rolls has an adverse effect on sheet formation. The recent invention of a travelling table roll assembly in which the axes of the table rolls may be made to travel at any pre-determined ratio to wire speed, may be the solution to this problem.

Greater water removal through the suction boxes appears to be highly desirable at high speed and a recent tendency to decrease the number of table rolls and increase the number of flat boxes has been noted. There is a good possibility that high vacuum on a few boxes is more desirable than low vacuum on many, but in either case we are at present limited by wire drag and wire wear.

Conclusion

In conclusion, there seems to be no great difficulty in building our paper machines so that they will be mechanically satisfactory at speeds up to 2000 f.p.m. but further intensive study of the problems of proper drier evacuation as allied with even drying, and of sheet formation and drainage at high speeds is urgently needed.

The Minton Vacuum Drier in the Newsprint Industry*

By J. B. Gough[1] and H. S. Hill[2]

Part I—Description and Operating Characteristics (J. B. Gough)

The No-1 "Minton Vacuum Drier" 156 inch paper machine at Kenogami Mill of Price Bros. & Co., Limited installed in 1927, and the No-11 and No-12 "Minton Vacuum Drier" 234 inch paper machines at the Riverbend Mill of the same Company, installed in 1929, are the only vacuum drier paper machines in the world that have, so far, been designed, installed and operated for the production of newsprint. Several of these Minton vacuum driers have been more recently constructed however, and are in successful operation, both on the North American Continent and in Europe, drying various other pulp or textile fabrics, such as the highest grade of sulphite, burlap, etc., and indeed, wherever minimum steam consumption and minimum heat damage to the material being dried are of paramount importance. While these two factors of low total steam consumption and low drying temperature are also of considerable importance in the drying of standard newsprint, and are inherent and exclusive features of the Minton vacuum dryer, they are by no means the only advantages that result from this method of drying newsprint, when compared to even the most modern "Briner" equipped "standard" paper machine at present available.

As it is believed that these three Minton vacuum drier paper machines will therefore be of considerable interest to members of the Technical Association of the Pulp & Paper Industry and of the Technical Section of the Canadian Pulp & Paper Association, especially during this Joint International Meeting, when an opportunity has been provided to see these machines in operation, it has seemed desirable to present this brief and very general description of these machines and their general operating characteristics, for the information of those members who have not had a previous opportunity to study the Minton Drier, or to follow its operation and development since the first such machine was installed in the Kenogami Mill more than nine years ago. Although these machines have now been in operation for a sufficient length of time, especially so in the case of the No-1 Minton at Kenogami, to fully establish their various operating characteristics, and upon which operation all previous and succeeding statements in this paper are based, it is not considered desirable at this time and upon this particular occasion to present, in detail, all of the operating and technical data now available, but to present this upon a later occasion.

Description of the Drier

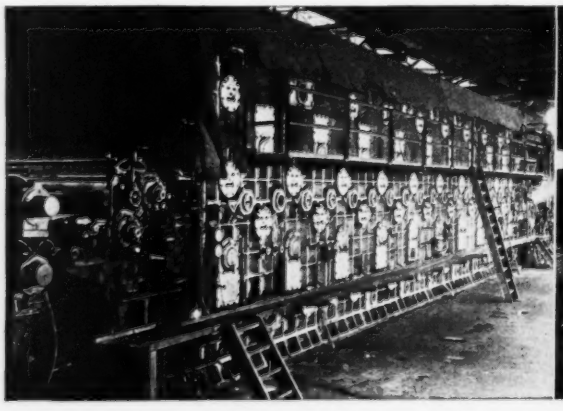
The Minton vacuum drier consists of a nest of about half the number of cylindrical driers usual in a standard atmospheric drier part, arranged, together with their felts, felt rolls and doctors, etc., in the normal manner, but all totally inclosed in a rigid, air-tight cast iron case, or box, which also forms the support for the anti-friction drier and felt roll bearings, etc. The rear journal of the driers is extended through the rear wall of the case to provide the drive and is also fitted with an air-tight stuffing box and a special design of steam head for the inlet and outlet of the steam and condensate. The drier doctors are operated from the front side, the operating shafts being brought through a stuffing box in the case. There is no backtender rope or other mechanical device for passing the paper, this being satisfactorily and efficiently accomplished by the use of air jets, using atmospheric air. The case is amply provided with interior illumination and numerous air tight windows for the observation of the sheet, draws, doctors, felt stretchers and automatic guides and for passing the sheet.

No-11 and No-12 Mintons are equipped with a normal spur gear drive and a single large motor, while No-11 Min-

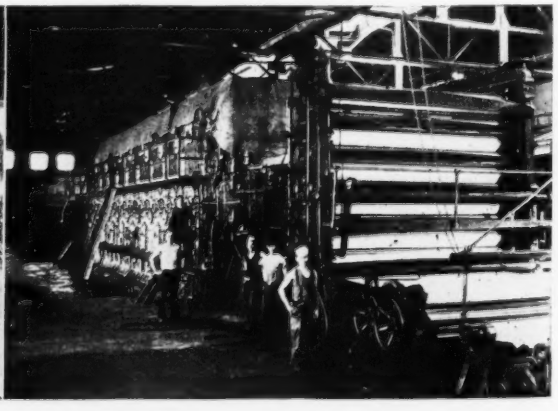
* Presented at the International Technical Meeting of the Technical Association of the Pulp and Paper Industry and the Technical Section of the Canadian Pulp and Paper Association, Montreal, P. Q., August 3-7, 1936.

[1] Member TAPPI, Engineer, Price Bros. & Co., Ltd.

[2] Member TAPPI, Director of Research, Price Bros. & Co., Ltd.



No. 1 Minton Vacuum Drier at Kenogami, Showing the "In-going Seal" in the Foreground to the Left.



No. 1 Minton Vacuum Drier at Kenogami, Showing the "Out-going Seal" in the Foreground to the Right.

ton is equipped with individual drier motors and enclosed worm gears which are all mounted on the rear wall of the case.

No-11 and No-12 paper machines are equipped with the Harland sectional electric interlock drive, and No-1 paper machine with the General Electric sectional interlock drive.

The Air-tight Seals

Possibly, the most interesting and important detail of the Minton vacuum driers is the means provided for passing the sheet into and out of the drier case, without breaking or injuring the delicate web and without causing an undue leakage of air into the case. As a very high vacuum is maintained inside the case, usually between 26 and 28 inches mercury, which is about equivalent to a pressure of 12.72 to 13.69 pounds per square inch below that of the room air outside the case, it will be apparent that considerable care in the design and in the operation is necessary to prevent air leaking into the case at these points, as well as at the various other joints and stuffing boxes, etc. Especially is the maintenance of this high vacuum essential if the full economy of the Minton vacuum drier, and the exclusive and characteristic qualities in the sheet which it produces, is to be fully realized, and without using an excessively large vapor condenser and air vacuum pump.

The device, apparatus and arrangement provided for the air-tight entrance and exit of the sheet is known as the "in-going" seal and "out-going" seal, which, in each case, consists of a pair of bronze covered rolls, not in contact, and one rubber covered roll which makes intimate and air-tight line contact with each of the two bronze rolls, and rotates with them; each of the bronze rolls being driven by an electric motor, suitably connected to the paper machine drive and electric interlock, and provided with means for draw adjustment. The ingoing and outgoing sheet is passed through one or the other of these intimate but soft nip contacts, thus maintaining an air-tight seal at these nip contacts, regardless of whether the sheet is there or not, and including the marginal width beyond the edge of the sheet. Since these three rotating rolls, each touching the other, must form an air-tight seal, or barrier, in the gap provided for them at each end of the case, and as only the soft rubber seal roll is made air-tight by the contact of a bronze roll on each side of it, it is necessary to provide a seal between each of the bronze seal rolls and the case. This is accomplished by means of two long rubber sealing strips, which, mounted and held in the case, make a smooth and water lubricated contact with the surface of the rotating bronze roll, throughout its length.

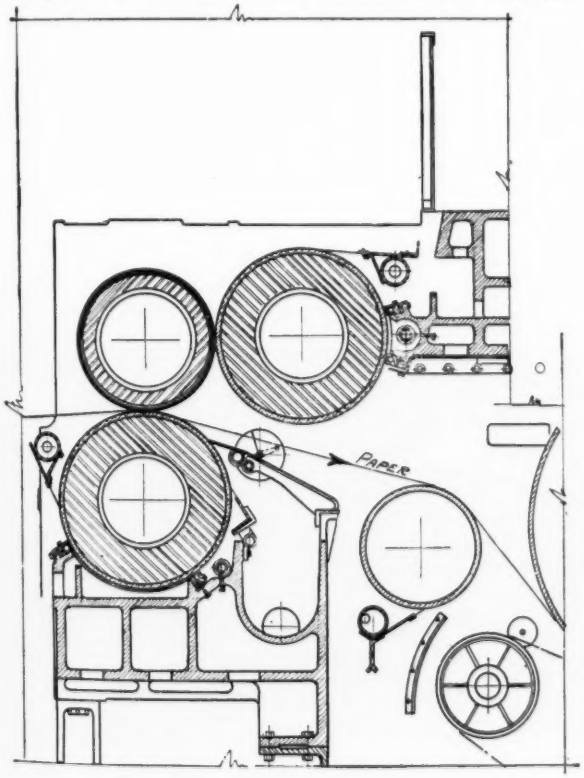


FIG. 1
"In-going Seal."

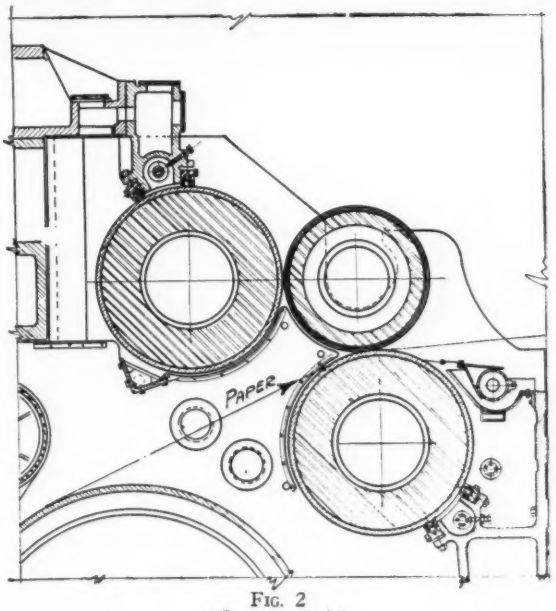


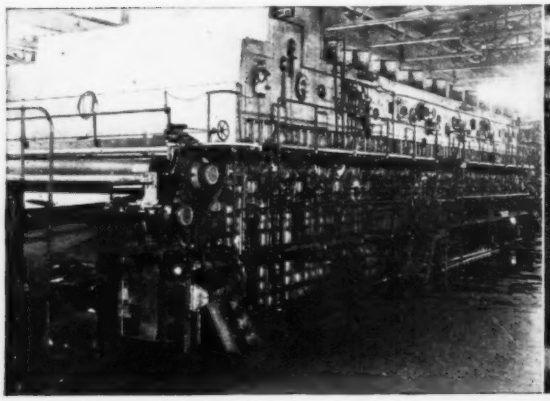
FIG. 2
"Out-going Seal."

These long rubber sealing strips, which make an air-tight seal between the surface of the rotating bronze rolls and the corresponding stationary edge of the gap in the case, are backed up with light rubber tubes, under regulated and adjustable water or air pressure, which allows of the rubber sealing strips being pressed lightly and uniformly against the wet surface of the rotating bronze seal roll. The two long rubber sealing strips, acting in "series" on one roll, are provided with water pockets which wet the surface of the roll, this water acting both as a sealing and lubricating liquid, with one sealing rubber acting mainly as a sealing device and the other rubber acting mainly as a wiping device, just before the bronze roll makes contact with the sheet or the rubber roll, as the case may be.

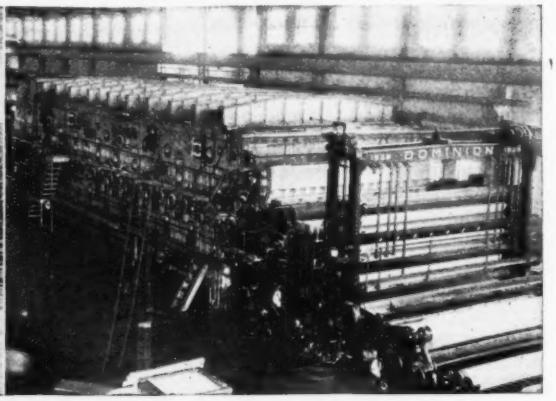
The ends of all these rolls have to be provided with a very similar device to prevent the leakage of air between the flat end of the rotating roll and the stationary cast iron case, except in this instance, since water cannot be used for lubrication or sealing, a high lead bronze is used instead of rubber, as this requires no lubrication.

The rubber seal roll is held in place by the pressure of the atmosphere, this providing ample pressure at the nips, and eliminating what would otherwise prove to be a difficult crowning problem. Both hand and automatic gear is fitted to this roll, however, so that, not being in fixed bearings, it can be adjusted or removed from contact with the bronze rolls, when required.

It can be seen from the above brief description that the ingoing and outgoing seals are a rather intricate and quite precise piece of apparatus, when compared to anything met



No. 12 Minton Vacuum Drier at Riverbend, Showing the "In-going Seal" in the Foreground to the Left.



No. 12 Minton Vacuum Drier at Riverbend, Showing the "Out-going Seal" in the Foreground.

with on a standard paper machine with atmospheric driers, and require careful and skillful attention. While in the early days these seals undoubtedly gave a great deal of trouble, and still require more attention and repair than any other feature of the vacuum drier, it can be very definitely said that, partly as a result of careful and skillful attention, and partly as a result of numerous detail changes in design and material, these seals now operate in a much more satisfactory manner than formerly, and, while still the cause of an occasional shutdown, the lost time so caused is not now considered unduly excessive.

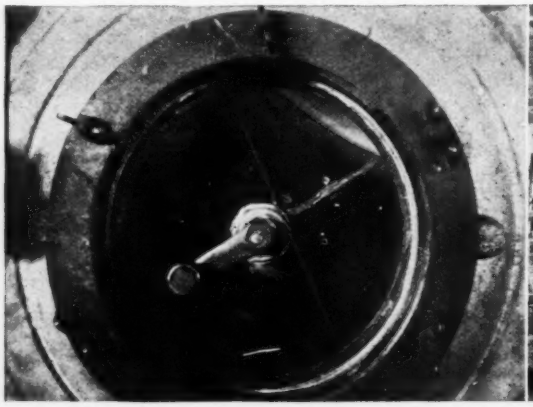
Figs. No-1 and No-2 show the assembly of the ingoing and outgoing seals on No-11 and No-12 machines at Riverbend, as originally installed.

The vapor condenser and dry vacuum pump are the only other items of particular interest or importance. The vapor surface condenser is of the usual modern heart-shaped 2-pass design, complete with air-cooler, using mill fresh water as the cooling and condensing medium. The dry vacuum air pump is a single stage, two cylinder, double acting, horizontal, reciprocating type, belt driven from an electric motor on No-1 Minton, and direct connected to a synchronous electric motor on No-11 and No-12 Mintons. This condensing equipment has sufficient capacity to condense the vapor from the sheet and also evacuate such quantities of air as leak into the case with the sheet, or through the various joints and stuffing boxes, when the paper machine is operating at 950 to 1000 f.p.m. on 32-pound paper. It maintains a vacuum in the case of between 26 and 28 inches mercury depending somewhat on the barometric pressure of the atmosphere, the wetness of the sheet to the driers, and the condition of the seals and condenser.

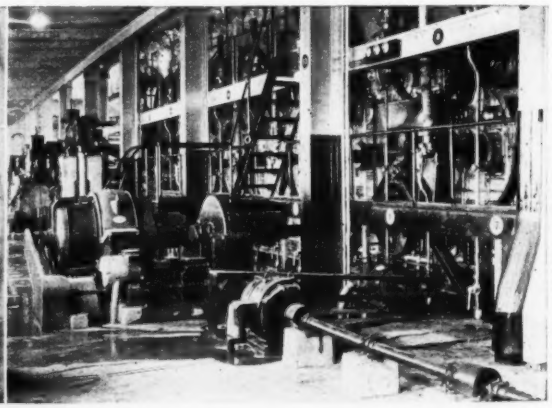
Thermal Efficiency

With further reference to the lower total steam consumption of the Minton vacuum drier per ton of finished and acceptable paper, compared to the total steam consumption of a standard atmospheric drier, even when equipped with the usual size of Briner economizer, a simple theoretical investigation should convince one that it would be very surprising if the thermal efficiency of the Minton vacuum drier was not appreciably higher than that of the atmospheric drier and Briner economizer, when compared upon a proper basis, that is, total steam used divided by total acceptable paper made. The wet end and other operating conditions, such as moisture to driers, speed, trim, lost time, etc., which should not be affected by the drying system, should be the same in each case, since there is no theoretical, logical, or practical reason why these should be different, except, possibly in regard to lost time.

While it is certainly a very difficult matter to make a thorough test and heat balance of either the atmospheric or vacuum drier, when in normal operation, and while the writer has never seen nor heard of any test on an atmospheric drier and Briner economizer which would compare with the tests made on No-1 Minton in 1927 and 1928,



A View of the Sheet and the Ends of the Drier Cylinders, as Seen When Looking Through the Air-Tight Detachable Glass Windows of the Case.



The Back of No. 12 Minton Vacuum Drier, Showing the New Standard Gear Single Motor Drive.

and No-11 Minton in 1930, in regard to accuracy, completeness, or length of test, it is possible to make a very simple and quite accurate comparison, based on the data in Table I alone:

TABLE I

	Minton Vacuum	Atmospheric
Moisture in sheet to driers	69.6%	69.6%
Moisture in sheet from driers (before S.D.)	6.0%	6.0%
Temperature of sheet to driers	65°F.	65°F.
Outside temperature of air	35°F. at 80% H.	35°F. at 80% H.
Temperature of evaporation	108.6°F. (27.5")	185°F.
Temperature of vapor to condenser	130°F.	.....
Temperature of vapor to economizer	.....	124°F. at 70% H.
Temperature of vapor from economizer	.....	111.5°F. at 100% H.
Temperature of air mach. room to driers	.....	80°F. at 46% H.

Assuming that there is no trim loss, broke loss, or time loss, on either drier, and that the above are reasonable yearly average figures, and using no other data or assumptions, except the published thermodynamic tables on steam and humid air, we get Table II.

TABLE II

Vacuum Drier:	
Steam, F. & A. per ton of paper dried	= 4,700 lbs.
Steam for heating seal water	= 263 lbs.*
Warming up steam at week-ends	= 49 lbs.*
Steam for ventilation air	= 559 lbs.*
Total	= 5,571 lbs.
Atmospheric Drier:	
Steam F. & A. per ton of paper dried	= 4,870 lbs.
Steam loss, due to use of air (Inc. Vent.)	= 1,978 lbs.
Total	= 6,848 lbs.

* The steam for warming up the Minton at the week-ends, and for heating the seals continuously, is taken from numerous actual tests on the Minton, and is added here in order to make a fair comparison of past performance. The above charge for steam for seal water is based upon the use of cold fresh water, however, and this is no longer used, thus cutting this charge to about 50 pounds per ton on No-11 and No-12 and 0 pounds on No-1.

The steam charge for heating the air required for ventilation of the Minton machine room has also been added to the total chargeable to the vacuum drier, based upon the actual requirements of about 29,000 pounds of air per ton, since the corresponding charge is already included in the atmospheric drier figure.

The steam required for heating the respective buildings is not included, but obviously, less steam will be required for the small Minton building.

While, with the exception of the steam for warming-up, seals and ventilation, charged to the vacuum drier in the above result, these two comparable results are theoretically calculated and correct, assuming the basic data given is correct, and on the assumption of no trim loss, broke, or lost time, the actual steam per ton of finished and accepted paper will, of course, be much higher, on both machines due to these losses, as well as due to injection water and leaky traps, etc.

Also, while the air data given above for the atmospheric drier is based upon an actual Briner test of a modern wide machine, and works out at 7900 pounds of air per ton of paper dried, again at 100 per cent efficiency, with a vapor pick-up in the driers of 370 grains per pound of dry air used, this pick-up may vary from 300 to 500 grains per pound on different machines, thus materially affecting the quantity of air used and the steam consumption per ton. It has also been assumed that the heat saved by the Briner, in this case 325 pounds per ton, and which has been duly credited, is returned to the same machine room and is thus on the same basis as unavoidable radiation from the driers and hood, or alternately, from the Minton case, although in the summer part of this heat recovered by the Briner may have to be thrown away. In the case of the Minton, the case radiation, amounting to about 100 pounds per ton, is definitely required throughout the year, as even in summer, a small amount of live steam is used, in addition, for heating the relatively smaller building.

Taking all of these possibilities into account, it is very probable that the vacuum drier should be now charged with not more than 5600 pounds per ton and the atmospheric drier with not less than 6800 pounds per ton, which is 1200 pounds or 21½ per cent more steam. This difference increases as both the machine efficiencies are equally reduced below 100 per cent. That the vacuum drier is more economical of steam is very definitely borne out by the actual operating records of No-1 Minton at Kenogami and No-12 Minton at Riverbend, although in the case of No-11 Minton at Riverbend this has not so far been true, generally, but under present full operation and with the various improvements already installed, or contemplated, there is little doubt that a similar satisfactory result will be achieved.

No-11 and No-12 Mintons each use four "Miracle" cotton drier felts, with 1-60 inch diameter and 1-48 inch diameter felt drier on each "wet end" felt. No-1 Minton uses two Ayres "wool-cotton" felts, but has no felt driers. All three Mintons have twenty 60 inch diameter driers and 1 baby drier in contact with the sheet and arranged for steam heating, although one or two of the driers at the "dry end" are generally run without steam.

Some Operating Items

Due to the fact that about twice as much water is evaporated from the sheet per square feet of drier surface per minute., than is the case with standard atmospheric driers, and as the volume of vapor released from the sheet is therefore more than 12 times as much, per square foot of drier surface, due to this high drying rate and high vacuum, a much more porous and expensive drier felt has to be used than found necessary on the atmospheric drier. These felts, however, run for about 275 days on No-11 and No-12 Mintons, and about 180 days on No-1 Minton, resulting, in the past, in a saving of about thirty-two cents ($0.32) per ton, when compared to the less expensive standard cotton felts used on the atmospheric driers of the other machines in their respective mills. These latter costs, however, have recently been considerably reduced on some of the atmospheric driers.

On account of the seal rolls, and also the individual drier motors on No-11 Minton, which it is intended to remove at an early date, and replace with a standard drive, as on No-12, the cost per ton for repair labor and supplies is about twenty-one cents ($0.21) per ton higher on No-11 paper machine than on No-9 or No-10 paper machines. This extra repair charge on No-12 paper machine, with a standard drier drive, will undoubtedly be less than twenty-one cents ($0.21). On No-1 Minton, which is a narrow machine, the repair charge is six cents ($0.06) per ton more than the average of the four narrow atmospheric machines in the same mill. This differential charge includes all the extra expense for grinding bronze and rubber seal rolls, replacing rubber seal rolls, rubber seal strips and end sealing rings, etc., and one special attendant in each shift whose duty it is to look after the Minton section exclusively.

Comparing the machine production and efficiency of No-11 Minton paper machine with No-9 and No-10 atmospheric drier paper machines, all wide and otherwise similar machines in the same mill, the daily production on No-11 has been about ten (10) tons less and the machine efficiency about one per cent (1 per cent) less than No-9 and No-10 in the past, but for some months now the efficiency has been at least equal, or better, than No-9 or No-10. The differential of ten (10) tons, at present chargeable against the Minton, would more than be wiped out by the addition of two more driers. In this connection, also, it is well to remember that No-11 Minton is still a comparatively new design of drier part, with its own peculiar operating problems and difficulties, and that, up to a comparatively recent date, it has been operated very intermittently indeed, and that, under steady and continuous operation, as in recent months, it is only reasonable

to expect considerable improvement on all points so far dealt with in this paper, as well as in what is, possibly, the most important point of all, the quality of the paper it produces, which important feature of the Minton vacuum drier will be dealt with by my co-author later in this paper.

Power charges on No-11 Minton are between ten cents ($0.10) and twelve cents ($0.12) per ton higher than on No-9 and No-10 paper machines, including drier and seal motors and vacuum pumps, etc. Without anticipating, therefore, what Dr. Hill will have to say on the subject of vacuum dried newsprint, it would appear that there are considerable operating advantages in the Minton vacuum drier, and, while these advantages are, more or less, offset by certain operating disadvantages, these disadvantages are not necessarily as inherent to the principle of vacuum drying, nor is it reasonable to suppose that continued operation and accumulated experience will not greatly reduce them in the immediate future, as indeed, is already apparent.

As a result, therefore, of a very great deal of care, attention and experimentation in the past, during which very real operating difficulties have been met and largely overcome, involving considerable delay and expense, the Minton vacuum drier today can be truly considered a practical and efficient machine for the drying of newsprint, and, while, for various reasons, the full advantages of this machine, originally anticipated, have not yet been fully realized in actual operation, and due to the present changed extraneous conditions, cannot now be ever fully realized, the members of the organization, past or present, who by their effort and courage have contributed to this result, are to be congratulated.

Part II—The Quality of Vacuum Dried Paper (H. S. Hill)

Early in the work with the Minton vacuum drier, it became apparent that the newsprint dried thereon possessed a somewhat distinctive character, and, in fact, showed up this character in practically all of the known paper quality tests. As compared with newsprint made on regular type driers, and under otherwise similar operating conditions, vacuum dried newsprint from a given stock was found to be brighter, more opaque, softer, more porous, more absorbent both to oil and water, smoother as tested by the Bekk or similar type instruments, and was found to show a somewhat lower Mullen and tensile strength test, a slightly higher tear test, about equal stretch at the breaking load, and a slightly higher stretch at lower loads.

Each of these relationships between vacuum and regular dried newsprint may vary in degree depending on the character of the furnish and on certain machine conditions, particularly at the calender. Nevertheless, the above listed quality trends always persist, and furthermore, they may be verified in detail with laboratory scale drying experiments using standard hand sheets and controlled conditions. The existence, therefore, of what may be termed a typical vacuum dried effect on newsprint quality may be accepted as an established fact.

Analysis of Sheet Properties

A large amount of experimental work has been carried out for the purpose of defining and analysing the vacuum dried effect and of explaining, if possible, its ultimate cause; but for the purpose of the present paper, it will suffice to give a brief summary of some of the more important findings. One of the first conclusions to be reached in this investigation was that the typical vacuum dried effect has to do almost entirely with a somewhat lesser than usual degree of bonding between fibers in the vacuum dried sheet. It is easily demonstrated that a change in the bonding of fibers in sheets from a given stock will result in a change, not only in the strength of the sheet, but also in all of the paper quality factors as above listed. Thus, in the laboratory, bonding may be increased at will by such means as heavier pressing of a sheet in the wet state, or bonding may be decreased in the extreme by making the sheet with alcohol replacing water. In any such series it will be found that the sheet with less bonding between fibers will show greater brightness, greater capacity, greater softness, greater porosity, greater absorbency, greater smoothness (if calendered), greater thickness, together with a lower mullen and tensile strength and a higher tear test. It will be observed that this is precisely the trend of the changes produced by vacuum drying.

Another conclusion resulting from this study is that a principal cause of the less bonding of fibers, which in turn causes the typical vacuum dried effect, is the lower temperature of the sheet during vacuum drying. The maximum temperature of the drying sheet under usual vacuum is roughly 100 deg. F., as against some 200 deg. F. for regular atmospheric pressure. It is again easily demonstrated that this difference in temperature will affect the bonding of fibers in a newsprint sheet.

A secondary finding in this regard is that the temperature effect on the bonding of fibers is exerted primarily in the earlier, or wetter, states of drying. For example, if the first half of drying is done under vacuum, and the second half under atmospheric pressure, the vacuum dried effect persists, but if the reverse conditions are used, the vacuum dried effect becomes negligible.

Still another finding is that the groundwood component of a newsprint sheet is the principal recipient of this temperature effect exerted in the earlier stages of drying. Thus, if the furnish is varied from 100 per cent groundwood to 100 per cent sulphite, the typical vacuum dried effect will fall from a maximum to practically nothing. It should be pointed out, however that this conclusion should be limited to work on the experimental scale, and further that it should not be confused with the well known effect of vacuum drying on sulphite pulp. A distinction must be drawn between effects on sheet properties and effects on the properties of pulp which is to be reworked. It is even possible that the commercial Minton drier would produce certain characteristic effects on a sulphite sheet, but it appears at least that such changes would not be identical with those that are found in the case of groundwood.

In addition to the influence of lower sheet temperature, various other specific factors associated with Minton vacuum drying were also investigated in search of possible secondary effects. Among such factors may be listed:

Possible effect of higher rate of evaporation,
Possible disruptive effect of greater volume of vapor,
Possible disruptive effect of air in sheet entering vacuum,
Possible effect of volatization of fiber substance,
Possible effect of the Minton heal rolls,
Possible effect of extra draws,
Possible effect of absence of air in vacuum drying,
Possible effect of nature of felts, felt tension, and degree of contact of sheet with drier cylinder.

Systematic experiments were designed to test out these items, wherein the Minton drier operating characteristics differ from the regular drier, but in no single case was it

found possible to demonstrate any appreciable positive influence which would tend to produce this typical vacuum dried effect on paper quality. It is, of course, possible that certain combinations of the above factors may be playing some part, but from all the evidence to date, it appears safe to say that lower sheet temperature is the most active influence in producing the characteristic quality of vacuum dried newsprint.

Just how the higher sheet temperature of regular drying produces more bonding of the fibers has not been definitely established. Quite possibly the softening effect of higher temperature on the lignin or other non-cellulose components of groundwood renders the fibers more pliable and therefore more amenable to forming more bonding contacts under the various forces that are at work in and on the drying sheet. No evidence has been found that would point to the natural resins of the wood as the source of the observed temperature effect.

The Comparative Quality of Vacuum Dried Newsprint

No attempt will be made to define the quality of vacuum dried newsprint in absolute terms, since this sheet like that from the regular driers is subject to variation depending on the furnish used, and on operating conditions of the paper machine. Its characteristic quality, however, may be brought out by a brief comparison of its properties with those of paper from the regular machines operating on the same furnish and under essentially identical conditions. The following notes, therefore, are presented on a typical comparative basis of newsprint of standard weight.

Optical Properties—Brightness and Opacity

The brightness of vacuum dried newsprint ranges from two to three points brighter than regular dried, as tested by the Steel opacimeter. Thus, with regular dried testing 74 per cent reflectance, the vacuum dried sheet will test, say 76.5 per cent. This degree of difference may be detected with the eye by direct comparison, and, as is well known, small differences in brightness became accentuated on the printed page. The source of the extra brightness in vacuum dried paper is the lower degree of bonding between fibers. In a manner of speaking, it is brighter because it is less transparent. The opacity, therefore, of vacuum dried paper is above of regular dried in about the same ratio as found for the brightness property.

Softness

Vacuum dried newsprint is softer than regular dried, and this may be demonstrated either by feel or rattle, by a simple bending test, or by a suitable compression test. As a typical example may be quoted results from a simple test developed by the author to measure the relative compression softness of newsprint. On an arbitrary and somewhat magnified scale the test reading for the regular sheet may be about 70, as against, say, 90 for vacuum dried paper. A sulphite bond sheet on the same scale would test about 25. The instrument developed for this purpose appears to offer sufficient promise that work is proceeding to develop this for general use, and it is hoped that a description of this method will be early available.

Porosity

For a test value of 30 seconds (Gurley densometer) for regular dried newsprint, a comparative value for vacuum dried newsprint would be about 20 seconds. Higher readings on sheets from slower stock would show about the same ratio for the two types of drying.

Absorbency

Comparative values of absorbency as tested by the castor oil flotation method are: For regular dried newsprint, Top side 55 seconds; wire side 50 seconds. For vacuum dried newsprint, Top side 35 seconds; wire side 34 seconds.

Water absorbency also is greater for the vacuum dried sheet, but there is perhaps less significance here because apart from the influence of different sheet structure, there is also involved to some extent the phenomenon of natural sizing, but in the extreme low range.

Smoothness

A vacuum dried sheet of newsprint will usually give a higher smoothness reading than a comparative sample from the regular drier, as tested by the Bekk, Gurley, Williams or similar instruments. Using a modification of this type of test especially designed for newsprint, a reading of say, 150 seconds for regular newsprint would compare with 180 seconds for vacuum dried newsprint. A further characteristic here is that the vacuum dried sheet usually gives a higher smoothness reading for the wire side, which is contrary to the trend for regular newsprint.

There are two factors which combine to produce the higher smoothness reading for vacuum dried newsprint. The first is that the greater softness of this sheet renders it more amenable to a given calendering operation. The second is that the softness of the sample enters to some extent into the actual smoothness test, since in all instruments of the above type, the reading is taken with the sample under light compression. A comparison of smoothness under compression, however, seems all the fairer, since the effective printing smoothness of a sheet is also that which exists under compression in the printing press.

Thickness

Under normal operation the vacuum dried sheet after calendering is about one or two ten thousandths of an inch thicker than that from the regular machines. Before the calender, however, the vacuum dried sheet is about one thousandths of an inch thinner due to the light pressing it receives from the outgoing seal rolls of the Minton drier.

Strength Factors

For a mullen test of 9—10 or regular dried newsprint, a typical comparative value for vacuum dried would be 8—9.

Tensile strength, often shows a still greater spread between the two types.

Tearing strength, on the other hand, usually favors the vacuum dried sheet. This seemingly divergent trend between mullen and tear appears to be of the same nature as is frequently encountered in pulp testing, where a sheet of less strongly bonded fibers will show a higher tear test.

In view of the lower mullen strength of vacuum dried newsprint it is natural that the running qualities of this sheet at the press room have been very closely watched. It may be definitely stated, on the basis of some four years' continuous performance in a wide variety of pressrooms, and of a study of comparative break records, that vacuum dried newsprint runs equally as well as the regular dried product. This experience lends support to the growing belief that mullen strength within the above range has no appreciable relationship to the running or break records of newsprint on high speed printing presses.

General

It has been shown that by nearly every test, vacuum dried newsprint exhibits some characteristic difference in quality from comparative regular dried paper. It may be a point of further interest that, although for any one test the value for the vacuum sheet may not be greatly extreme, yet the combination of properties appears to be unusual, if not unique. It is significant that by no other practical means, save vacuum drying, has it been found possible to obtain a combination of such high softness, high

absorbency, and high smoothness. For example, attempts to raise the softness and to increase the absorbency of newsprint from the regular machines generally results in lower smoothness, while measures that raise the smoothness usually produce lower softness and lower absorbency, as well as trend to lower brightness and opacity. On the other hand, by proper adjustment of the furnish and machine conditions, it is possible to raise the smoothness of vacuum dried newsprint far above the usual range, but still retain the high softness and absorbency of normal newsprint.

Printing Qualities

Numerous well controlled press room trials have been made comparing vacuum dried newsprint with that made on the regular machines, and almost invariably the printing result has favored the vacuum dried product. This has been particularly true of multicolor printing on the letter presses, and also on the roto-gravure presses. From these practical trials, as well as from theoretical considerations, it is indicated that the combination of high smoothness, high softness and high absorbency is a favorable one for printing. Obviously, smoothness and softness of a sheet favors intimate contact with the printing faces and thus insures more precise definition both in the solids and the half-tones. Extra absorbency of the paper favors depth of tone as well as keeps the printed page cleaner from secondary effects of off-set and smudging. The absorbency factor is perhaps doubly important in the case of printing involving superimposed colors.

The extra brightness of vacuum dried paper aids in bringing out high-lights and in providing sharper contrasts on the printed page, and the added opacity, although slight, is in the right direction, and has about the same beneficial effect on show-through as would be obtained normally by an increase of one to two pounds in sheet weight.

In conclusion, it might be well to add that the foregoing discussion is not intended to convey the impression that vacuum dried newsprint represents any radical departure in paper quality. The product is very much a standard newsprint sheet, but one whose properties both singly and in combination appear to offer favorable trends. On the basis of printing results obtained, there is indication that vacuum drying may be a distinct aid in developing a semi-specialty newsprint for the color presses, both news and for certain classes of roto-gravure.

References

Other papers dealing with the Minton vacuum drier are as follows:
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"Thermodynamic Comparison of Paper Drying Methods," by Ogden Minton, at the Annual Meeting of the TAPPI, Feb. 24th, 1926, New York.
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"The Modern Method of Paper Drying," by Ogden Minton, at the Annual Convention of A. P. & P. M. S. A., June 2, 1928, Pittsfield, Mass.
"At What Temperature Should Paper be Dried," by Ogden Minton, Pulp & Paper Magazine of Canada, May 7th, 1931.
"Comparison of Atmospheric and Vacuum Dried Pulp," by J. S. Babbitt, Pulp & Paper Magazine of Canada, July 9th, 1931.

The System of Rosin Size, Alum and Fiber As Related to Problems in Paper Sizing*

By Samuel J. Robinson[1]

Abstract

The properties of the precipitate obtained on the addition of an excess of aluminum sulphate to a dilute sodium abietate solution have been investigated in order to develop an analytical method for studying the sizing mechanism.

It was found that the precipitate, when dried at 50 deg. C. in a vacuum oven, was completely soluble in benzene, chloroform, and absolute ether but insoluble in absolute alcohol and acetone. When commercial ether containing small amounts of moisture was used, the percipitate went into solution; but on standing one hour, a resinous material settled out. Abietic acid is soluble in alcohol, benzene, ether, and chloroform.

Tht Al_2O_3 content of the precipitate was found to be in fair agreement with the Al_2O_3 content demanded by a neutral aluminum abietate, $Al(C_{19}H_{29}COO)_3$, namely 5.50 per cent.

The filtered moist aluminum abietate, when dried at 80 deg. C. for ninety minutes, was decomposed into two portions, one of which was soluble in chloroform, benzene, and absolute ether, and a second portion insoluble in these solvents. The soluble portion contained a low percentage of aluminum oxide, and probably consisted of a mixture of free abietic acid and aluminum abietate. The insoluble portion contained a high percentage of aluminum oxide and probably consisted of a mixture of two basic aluminum abietates. The same was found to hold true for a commercial paper. Air dried paper extracted with chloroform contained a higher percentage of rosin and a higher Al_2O_3 content than the same paper that had passed through the drier sections. This substantiates the work of Remington, Bowack, and Davidson (25) and Schutz and Klauditz (26); they studied the effect of heat on precipitates of aluminum abietate in the absence of pulp fibers.

In contrast to the opinions of Olsen and Gortner (23), it was found that all of the rosin precipitated on the fibers could be extracted with a neutral solvent such as chloroform if the sized fibers were air dried or dried in a vacuum oven at 50 deg. C.

The reaction between an excess of aluminum sulphate on four different beater concentrations of sodium abietate was investigated in the absence of pulp fiber; only the normal aluminum abietate was formed by this reaction; the results obtained confirms the work of investigators such as Heuser (14), Oeman (21), and Shutz and Klauditz (26). However, when the same reaction was studied in the presence of eight different pulps at three different beater concentrations of sodium abietate, abietic acid as well as aluminum abietate were precipitated on the fibers. The amount of free abietic acid was found to vary with different pulps and different concentrations of sodium abietate. The abietic acid present was due to the action

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[1] Student, Institute of Paper Chemistry, Appleton, Wis.

of the pulp fibers in forcing the hydrolysis of the dilute sodium abietate solutions.

Beater runs were made on the eight different pulps using both sodium abietate and commercial rosin size containing thirty per cent free rosin.

In making size tests on hand sheets made from the various pulps it was found that the relative sizability of the pulps varied depending on the size tests employed. This is also the case in mill practice.

When the size tests were compared with the degree of hydrolysis of the sodium abietate solutions as effected by the various pulps, no definite relationship could be established. Size tests of hand sheets made from eight different pulps sized with sodium abietate are compared with size tests of sheets sized with a commercial rosin size (30 per cent free); no superiority of one rosin over the other was apparent.

Size tests were made on air dried sheets as well as on sheets dried at 105 deg. C. for ten minutes; in most cases the air dried sheets gave higher size tests. These results are in disagreement with many investigators.

Air dried sheets were extracted with chloroform and their retentions determined; when the various pulps are studied there seems to be no apparent relationship between the size tests and the rosin retentions. This is often found to be the case in mill practice.

Correlations between size tests and other variables studied were difficult due to variation in the relative sizability of the pulps when different size test methods were employed.

It must be assumed that the total quantity of rosin present, including the various proportions of free rosin and aluminum resinate, must be fundamentally related to the size characteristics of paper. Failure of any size test employed to reflect the factor in the finished sheet emphasizes either the inadequacy of size tests now employed or perhaps the importance of certain mechanical and temperature effects which come into prominence with respect to sizing during the formation of the sheet.

The sizing of paper represents one of the important steps in the manufacture of various grades of paper. The chief process of sizing paper consists in the addition of rosin size and alum to the beater containing fiber stock. Under these conditions the rosin size and alum may undergo various reactions and enter into numerous chemical and physical equilibria, not the least of which involves a certain amount of hydrolysis; the colloidal nature of the rosin and cellulose fibers may alter any classical chemical reactions and the impurities accompanying the rosin, alum, pulp, and water may greatly influence the sizing mechanism. Moreover, at every step in the manufacture of paper from the time that the rosin size is added to the beater until the paper has passed through the calender stacks variables may enter to greatly influence the size characteristics of the finished sheet. Some of the products which investigators have suggested as the true sizing agents are free rosin, aluminum resinate, basic or acid aluminum resinate, basic aluminum sulphate and alumina, either singly or in various combinations with each other.

In view of the variable source and nature of the materials and variables in the manufacturing process, the problem of rosin sizing must be investigated stepwise, simplifying the system as much as possible, beginning at the fundamentals, using chemically pure materials and keeping all conditions under definite control.

The first step in this method of attack was made by Bialkowsky *(4)* when he investigated the degree of hydrolysis of sodium abietate solutions and the effect of cellulose fibers on dilute sodium hydroxide and sodium abietate solutions. The next step in continuing these studies is the addition of aluminum sulphate to the above systems. The particular phase of the problem covered by this investigation includes the effect of excess aluminum sulphate solutions on dilute sodium abietate solutions in the absence and presence of pulp fibers and a comparison of the relative ease of sizing of various pulps in relation to their behavior to sodium abietate and aluminum sulphate solutions.

Historical Survey

The mechanism of the sizing process has been a subject of much discussion and experimental work resulting in voluminous literature representing a number of different theories and viewpoints. A brief and concise review of the work reported and the theories advanced by different investigators is regard to the mechanism of the sizing process has been published by Bialkowsky *(4)*. For a more complete review, reference may be made to papers by Olsen and Gortner *(24)* and Klein *(16)*. A brief complementary resume in particular regard to certain technical aspects of the sizing process, namely drying and heating effects, rosin determinations and size tests will be appended in connection with the present work.

Drying and Heating

Klemm *(17)* finds that engine sized papers are not fully ink resistant if dried at too high or too low a temperature. He considers 50 deg. C. about right. This temperature must be reached while the sheet is still wet, as dry rosin does not melt at as low a temperature as when moist. The first drier should not be too hot, then raise the temperature of the paper rapidly to 80 deg. C. and gradually lower it to the end of the bank. In a later paper Klemm *(18)* says that fritting (incipient fusion) takes place at 70 to 80 deg. C. and before the moisture content of the sheet falls below fifty per cent and forms a continuous impervious film. Heuser *(13)* states that the last step in sizing is sintering on the driers at a temperature of 70 to 80 deg. C. before the moisture content falls below fifty per cent. Minton *(20)* found that a temperature of 38 deg. C. would not develop sizing in paper made from well sized stock but that 77 deg. C. gave good results. Minor *(19)* states that paper taken from the machine before reaching the driers and then air dried is usually poorly sized as compared with that which is dried as usual. He adds that if the amount of alum is insufficient the sizing is not increased by the heat of the driers.

Heilmann *(12)* points out that poorly sized paper, to which enough rosin size has originally been added to size it well, is greatly improved when heated for a minute at 105 deg. C. Schwalbe *(27)* studied the effect of heating on sizing. One specimen gave a sizing test of 240 seconds as it came from the machine, 866 seconds after pressing with a flat iron at a temperature of 95 to 100 deg. C. and 6,540 seconds at a temperature of 250 deg. C. An anonymous writer *(2)* states that poorly sized paper can be made well sized by dampening and rapidly drying at 1100 deg. C. while unstretched.

Edge *(7)* studied the effect of temperature on sizing but found no sudden change at the melting point of the rosin. Oeman *(22)* found that strong heating of the moist paper sheet is detrimental to sizing. He found that if rosin sized paper with a moisture content of 45 per cent or more is warmed to 75 deg. C. for one minute the degree of sizing is greatly decreased or even destroyed. Harrison *(10)* confirms Oeman's statement that the relation between moisture content and drying temperature is an obscure one. The results of tests on air dried sheets indi-

cate that a high drying temperature is not always essential for the development of sizing.

G. M. *(9)* found that for a neutral size it made no difference whether the paper had been air dried or cylinder dried but when a high free rosin size was used, the size tests were increased by having the paper cylinder dried.

Rosin Determinations and Size Tests

Croswell, Dreshfield, and Heller *(6)* found that laboratory hand sheets retained around 40 per cent of the size added as compared to 80 to 90 per cent retention in mill runs. This difference is attributed to the high dilution of the stock in making the hand sheets.

Edge *(8)* states that the rosin content of the paper does not necessarily bear any relation to its sizing.

Sutermeister and Torrey *(28)* find that the usual extraction of paper with alcohol acidified with acetic acid will not remove all the rosin, nor will this treatment followed by extraction with ether. If sulphuric acid is used in place of acetic, practically complete extraction is obtained but it is necessary to siphon the solvent many more times than the twelve times recommended in the standard method. Olsen and Gortner *(23)* found that a neutral ether extract does not remove all the rosin adsorbed since subsequent extraction with acidified alcohol yields a rosin-like material which is soluble in ether. They claim that it is not a case of solubility but suggest that the charge of the fibers must be neutralized so as to release the rosin particles.

From a study of thirty-eight methods, Carson *(5)* concludes that the dry indicator method and the curl method gives the most consistent and dependable values for the degree of internal sizing. Alexander *(1)* studied the Valley tester and found that its results were greatly influenced by the furnish and formation of the sheet. He found no relation between the Valley test and the ink flotation test and concluded that the Valley tester could not be used for comparing the sizing qualities of different grades of paper.

Presentation of Problem

In the sizing of paper in the beater, a very complicated system is set up consisting of pulp fibers, water, rosin size, alum, and all the impurities normally present wtih each of these materials. Since sodium resinate is the salt of a strong base and a weak acid and aluminum sulphate is the salt of a weak base and a strong acid and both are in a highly diluted state in the beater, a certain amount of hydrolysis is expected. On hydrolysis free colloidal rosin and alumina would be formed and as these two substances are highly insoluble in water there could be no aluminum resinate formed. Hence, if aluminum resinate is formed, it must be derived from the reaction between sodium resinate and aluminum sulphate. The aluminum resinate, in contrast to a rosin-alumina aggregate, should have a definite chemical composition and show definite solubility properties. Beedle and Bolam *(3)* and Bailkowsky *(4)* found that sodium abietate undergoes very little hydrolysis at beater concentrations while Haug *(11)* and Ivanov *(15)* claim that the sodium soap undergoes complete hydrolysis at dilutions existing in the beater. However, Bialkowsky *(4)* showed that cellulose fibers played an important role in the sizing mechanism, due to their ability to reduce the alkalinity of the sodium resinate with the resulting formation of free colloidal rosin. Since Bailkowsky *(4)* has established that dilute sodium resinate solutions undergo hydrolysis in the presence of pulp fibers but fail to do so in their absence, a relatively larger amount of free rosin and smaller amount of aluminum resinate is to be expected on the addition of aluminum sulphate in the present of pulp fibers than in their absence. The relative amounts of aluminum resinate and free rosin found in the rosin-alum precipitate is, therefore, a clue to the mechanism involved in the sizing reaction as well as a measure of the degree of hydrolysis of the sodium resinate as its exists in the beater. This particular report deals first with a study of the properties of the product obtained on the addition of aluminum sulphate to dilute sodium abietate solutions in order to develop an analytical method for studying the sizing mechanism; secondly, with an investigation of the reaction between an excess of aluminum sulphate and dilute solutions of sodium abietate in distilled water in the absence and presence of pulp fibers by means of the method developed; thirdly, with a determination of the relative ease of sizing of various pulp fibers, employing beater runs, in relation to their behavior toward sodium abietate and aluminum sulphate; and fourthly, with the effect of such variables as drying temperature and rosin retention on the sizability of a given pulp.

EXPERIMENTAL DISCUSSION

A. Properties of the Precipitate Formed on the Addition of an Excess of Aluminum Sulphate to Dilute Sodium Abietate Solutions and Development of an Analytical Procedure.

1. Materials

Preparation of Abietic Acid: Six hundred grams of commercial abietic acid was refluxed for one hour with 98 per cent acetic acid. The mixture was filtered, cooled, and allowed to crystallize. The crystals were filtered as dry as possible on a Buchner funnel using suction. The crystals were then washed with successive portions of cold 85 per cent ethyl alcohol. The abietic acid was then twice crystallized from absolute ethyl alcohol and air dried. The acid number was determined by dissolving exactly one gram of abietic acid in 125 cc. of 95 per cent ethyl alcohol and titrating with standard 0.1 N sodium hydroxide solution, using phenolphthalein as an indicator. The acid value found was 131.9 as compared to the theoretical acid value of 132.4 assuming a monobasic acid.

Preparation of a Standard Sodium Abietate Solution: A 0.1 N solution of sodium abietate was prepared by dissolving 30.23 grams of abietic acid in 506.3 cc. of 0.1975 N·NaOH and then diluting to exactly one liter. A clear straw yellow solution was obtained. Solutions of lower concentrations were made from this standard solution by careful dilution. Distilled water essentially free from carbon dioxide was used throughout.

Preparation of a Standard Aluminum Sulphate Solution: A 0.1 N solution of aluminum sulphate was prepared by dissolving 5.702 grams of C.P. aluminum sulphate in carbon dioxide free distilled water and diluted to exactly one liter.

Preparation of Pulp Samples: The various pulps as obtained from the mills were torn up into small pieces, sampled and air dried. The pulps were then disintegrated in the Gosta Hall pulp disintegrater and placed in stoppered containers.

2. Method of Procedure and Data

100 cc. of 0.1 N sodium abietate solution was precipitated with three times the theoretical amount of aluminum sulphate. This should give 0.3102 grams of aluminum abietate if no hydrolysis has taken place and all of the sodium abietate is converted into the aluminum soap. The precipitate was dried in a vacuum oven at 50 deg. C and extracted with benzene and filtered.

Weight of extractive No. 1 = 0.3118
Weight of extractive No. 2 = 0.3123

Additional precipitations were carried out under the above conditions and the aluminum abietate dried under the above conditions was found to be soluble in benzene, chloroform, and absolute ether but unsoluble in absolute alcohol and acetone. Abietic acid was found to be soluble in alcohol, benzene, chloroform, and ether. If the aluminum abietate was dissolved in commercial ether containing small amounts of water, part of the aluminum abietate settled out on standing. On ashing the evaporated and weighted benzene extract, it was found that the Al_2O_3 content was in fair agreement with the Al_2O_3 content demanded by the formula $Al(C_{19}H_{29}COO)_3$.

Weight of benzene extract No. 1 = 0.3143 grams
Weight of benzene extract No. 2 = 0.3206 grams
Weight of Ash (Al_2O_3) in No. 1 = 0.0168 grams
Weight of Ash (Al_2O_3) in No. 2 = 0.0173 grams
Per cent Al_2O_3 in No. 1 = 5.37
Per cent Al_2O_3 in No. 2 = 5.40
The theoretical percentage of Al_2O_3 is 5.49

When the wet filtered precipitates were dried in an electric oven at 80 deg. C. the aluminum abietate which was originally white in color turned brown and exhibited different properties than that of the aluminum soap dried at 50 deg. C. in a vacuum oven. It was found that only part of the precipitate was now soluble in benzene. Boiling the insoluble portion in benzene did not increase the solubility.

Weight of precipitate No. 1 Soluble in benzene = 0.1643 grams
Weight of precipitate No. 2 Soluble in benzene = 0.1611 grams
Per cent of precipitate No. 1 Soluble in benzene = 52.6
Per cent of precipitate No. 2 Soluble in benzene = 51.6
Average per cent ash (Al_2O_3) in soluble portion = 2.85
Average per cent ash (Al_2O_3) in insoluble portion = 9.15

Commercial samples of paper were obtained that had gone through the press sections; these were air dried and extracted with chloroform and the extract ashed. Papers were obtained made under the same conditions except that these had gone through the driers. These were also extracted with chloroform evaporated and ashed. The rosin size used contained 60 per cent free rosin.

Per cent rosin in air dried paper as extracted with chloroform = 1.15
Per cent rosin in paper that had gone through the drier sections = 0.82
Per cent ash (Al_2O_3) in air dried paper = 2.35
Per cent ash (Al_2O_3) in machine dried paper = 1.69

A 0.01 N sodium abietate solution was precipitated with an excess of aluminum sulphate in the presence of pulp fibers. After filtering the fibers on a Buchner funnel using suction, the pad was dried in a vacuum oven at 50 deg. C. and then extracted for six hours in a Soxhlet, using benzene. At the end of this time it was observed that the benzene solution was quite turbid and that part of the aluminum abietate had precipitated out, due to decomposition in the boiling benzene solution. When this same procedure was repeated with chloroform, the solution was quite clear and on weighing the extract it was found that all of the rosin added to the pulp had been extracted. The lower boiling point chloroform did not decompose the aluminum abietate in the extraction process.

3. Discussion

On precipitating a dilute sodium abietate solution with an excess of aluminum sulphate, a white gelatinous precipitate is obtained. When this precipitate is dried at 50 deg. C. in a vacuum oven, it is completely soluble in benzene, chloroform, and absolute ether and insoluble in absolute alcohol and acetone. If the precipitate is dissolved in benzene and the solution filtered through a fritted glass crucible to remove traces of occluded aluminum sulphate, evaporated and analyzed for the aluminum oxide content, it is found that the per cent Al_2O_3 is in fair agreement with an alumina content demanded by a neutral aluminum abietate $Al(C_{19}H_{29}COOH)_3$. This would be the result of a reaction taking place as follows:

$$6\,C_{19}H_{29}COONa + Al_2(SO_4)_3 \rightarrow 3\,Na_2SO_4 + 2Al(C_{19}H_{29}COO)_3$$

However, if the net precipitate is dried at 80 deg. C., it turns brown and undergoes a certain amount of decomposition. The decomposition products can be divided into two parts; one of these is soluble in benzene, chloroform, and ether, and on analysis is found to have a lower Al_2O_3 content than the neutral aluminum abietate; the second portion is insoluble in these solvents and has a higher Al_2O_3 content than the neutral aluminum soap. Schutz and Klauditz *(26)* suggest that the following reactions take place at a temperature of 105 deg. C. in the presence of moisture:

1. $Al(C_{19}H_{29}COO)_3 + HOH \rightarrow Al(OH)(C_{19}H_{29}COO)_2 + C_{19}H_{29}COOH$
2. $Al(C_{19}H_{29}COO)_3 + 2HOH \rightarrow Al(OH)_2(C_{19}H_{29}COO) + 2C_{19}H_{29}COOH$

The percentage of Al_2O_3 in $Al(OH)(C_{19}H_{29}COO)_2$ is 7.11 and in $Al(OH)_2(C_{19}H_{29}COO)$ is 14.07. Both of these basic abietates are insoluble in benzene, chloroform, and ether. Since, in this investigation, it was found that approximately half of the aluminum abietate was converted into an insoluble portion having an average Al_2O_3 content of 9.15 per cent, it is probable that this portion may be a mixture of the two aluminum abietates as formed in the above reactions. Since the soluble portion had an average Al_2O_3 content of 2.85 per cent it is probable that it consists of a mixture of free abietic acid and neutral aluminum abietate. We should expect this same decomposition to take place at least in a portion of the aluminum resinate present in commercial paper as the wet web passes over the driers. Air dried paper was extracted with chloroform, evaporated, dried, weighed, ignited, ashed, and weighed, and it was found that the rosin content and Al_2O_3 content of the rosin was greater than in the same paper that had gone through the driers. This substantiates the work of certain investigators who claim that aluminum resinate formed in the beater is decomposed on the drier rolls.

When chloroform was used for extracting sized paper that had been dried at a low temperature or air dried, all of the rosin was extracted and no decomposition took place in the extraction flask. When benzene was used, some of the aluminum resinate extracted from the paper was decomposed into an insoluble portion in the boiling benzene. Olsen and Gortner *(23)* stated that all of the rosin could not be extracted from pulp fibers by means of a neutral solvent such as ether because the rosin particles were electrically charged; they claimed that an acidified alcohol solution was needed to neutralize this charge. The work carried out in this investigation indicates that a neutral solvent can be used to remove all the rosin providing the solvent is free of moisture and the rosin precipitate dried at a sufficiently low temperature or air dried. However, a neutral solvent cannot be used for commercial papers that have passed through the drier sections.

The method of procedure as adopted includes: 1. drying the rosin precipitate, in the absence and presence of pulps, at 50 deg. C. in a vacuum oven; 2. extracting the rosin precipitate with benzene and in the presence of fibers with chloroform; 3. determining the total weight of rosin by evaporation of the chloroform and the Al_2O_3 content by ignition of the extract; and 4. calculating the amount of free and combined rosin present.

B. Effect of Excess Aluminum Sulphite on Dilute Sodium Abietate Solutions in the Absence and Presence of Pulp Fibers.

1. Method of Procedure

Standard purified sodium abietate solutions, 0.0100 N, 0.0075 N, 0.0050 N, and 0.0025 N were made up by the

proper dilution of the 0.1 N sodium abietate solution with carbon dioxide free water. Erlenmeyer flasks of 500 cc. capacity containing 250 cc. of each of these solutions were placed in a bath of 20 deg. C. Three times the theoretical amount of aluminum sulphate was then added to each solution and the contents were allowed to stand for two hours in the bath with occasional shaking by hand. The precipitate was then filtered by means of suction and dried in a vacuum oven at 50 deg. C.; pH measurements were made on the filtrate by means of the LaMotte colorimeter method. The dried precipitate was then dissolved in benzene and filtered through a fritted glass crucible using suction. The benzene solution was transferred to a weighed platinum dish, the suction flask was rinsed once or twice with benzene and added to the dish. The benzene solution was then evaporated to dryness on an electric hot plate under a hood. After evaporation, the dish and contents were placed in an electric drying oven at 75 deg. C. and dried to constant weight. The dish and contents after weighing were carefully ignited over a small gas flame and then ashed in a muffle furnace to constant weight. Duplicate runs were made in all cases.

The following procedure was adopted for carrying out the above reaction in the presence of pulp fibers. Sufficient air dried disintegrated pulp to make ten grams of bone dry stock was placed in a 500 cc. Erlenmeyer and 250 cc. of this standard 0.01 N, 0.005 N, or 0.0025 N sodium abietate solution added. The pulp and sodium abietate were well mixed and allowed to remain in a bath at 20 deg. C. for 24 hours. At the end of this time, sufficient aluminum sulphate was added to give approximately the same pH as was obtained in the absence of fibers. The flask and contents were well shaken and allowed to stand in a bath at 20 deg. C. for two hours. The fibers were then filtered on a Buchner funnel using suction; the filtrate was poured repeatedly through the fiber pad formed until it became perfectly clear. The pad was removed from the funnel, broken up into small pieces by hand, placed on a large watch glass and dried at 50 deg. C. in a vacuum oven. The dried fibers were then placed in a fat free extraction for six hours in a Soxhlet extractor, with chloroform. The chloroform in the extraction flask was then transferred to a weighed platinum dish and evaporated to dryness on an electric hot plate. The platinum dish and contents were then dried in an electric oven at 75 deg. C. to constant weight. The rosin was then ignited over a small gas flame and then ashed to constant weight in a muffle furnace. Duplicate runs were made in all cases. Samples of pulp were extracted with chloroform to determine the amount of extractives originally present in the pulp.

2. Calculations

The following is a sample of the calculations made in compiling Tables I and II.

Weight of dish + extract		= 21.2333 g.
Weight of dish		= 20.8455
Total extract		0.3878 g.
Total extract		= 0.3878 g.
Pulp blank extract		= 0.0059
$Al(C_{19}H_{29}COO)_3 + C_{19}H_{29}COOH$		0.3819 g.
Weight of dish + ash		= 20.8643 g.
Weight of dish		= 20.8455
Weight of ash (Al_2O_3)		0.0188 g.
Per cent $Al_2O_3 = \frac{0.0188}{0.3819}(100)$		= 4.92
Weight of $Al(C_{19}H_{29}COO)_3 = (0.0188)(18.27)$		= 0.3435 g.
Weight of $Al(C_{19}H_{29}COO)_3 + C_{19}H_{29}COOH$		= 0.3819 g.
Weight of $Al(C_{19}H_{29}COO)_3$		= 0.3435
Weight of free $C_{19}H_{29}COOH$		= 0.0385 g.
Per cent of $Al(C_{19}H_{29}COO)_3$ based on weight of extract $= \frac{0.3435}{0.3819}(100)$		= 89.9
Per cent of free $C_{19}H_{29}COOH$ based on weight of extract $= 100.0 - 89.9$		= 10.1
Per cent of free $C_{19}H_{29}COOH$ based on bone dry weight of pulp $= \frac{0.0385}{10.000}(100)$		= 0.385
Per cent $Al(C_{19}H_{29}COO)_3$ based on bone dry weight of pulp $= \frac{0.3435}{10.000}(100)$		= 3.44

3. Data

Table I gives the results as to the composition of the precipitate obtained when three times the theoretical amount of aluminum sulphate is added to 250 cc. of the various sodium abietate solutions.

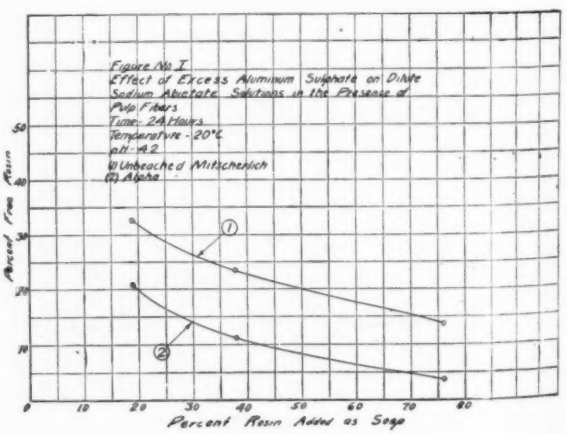
TABLE I
EFFECT OF EXCESS ALUMINUM SULPHATE ON DILUTE SODIUM ABIETATE SOLUTIONS

Normality of Sodium Abietate	Weight of extract, gms.	Weight of ash (Al_2O_3), gms.	Per cent ash (Al_2O_3)	Weight of aluminum abietate, gms.	Weight of free abietic acid, gms.	Per cent aluminum abietate	Per cent free abietic acid	pH filtrate
0.0100	0.7839	0.0416	5.30	0.7591	0.0248	96.8	3.2	4.1
0.0075	0.5945	0.0316	5.31	0.5717	0.0228	97.2	2.8	4.2
0.0050	0.3904	0.0215	5.52	0.3937	.....	100.8	...	4.2
0.0025	0.1702	0.0093	5.44	0.1699	0.0021	98.8	1.2	4.5

An excess over the theoretical amount of aluminum sulphate necessary to give the same pH as in Table I, in the absence of pulps was added to pulp suspensions in the dilute sodium abietate solutions. Table II shows the results obtained on the composition of the precipitate, and the effect of the pulp fibers on its composition.

5. Discussion

Table I, page 24, indicates that sodium abietate solutions at concentrations existing in the beater give only the normal aluminum abietate when precipitated with sufficient excess of aluminum sulphate to produce a pH that approximates that of a hard sized stock going over the machine. This confirms the work of Schutz and Klauditz *(26)*; they found that only the neutral aluminum soap was formed even when twelve times the theoretical amount of aluminum sulphate was used in precipitating the sodium abietate. The sodium abietate cannot be hydrolysed to any extent and at the same time react to form only the aluminum soap. If the sodium abietate at beater concentrations is hydrolysed completely, as is claimed by Haug *(11)* and Ivanov *(15)*, then no aluminum abietate could be formed since the insoluble colloidal free rosin would only be coagulated by the aluminum sulphate. The results obtained in this investigation indicate that in the absence of pulp fibers the sodium abietate is very little



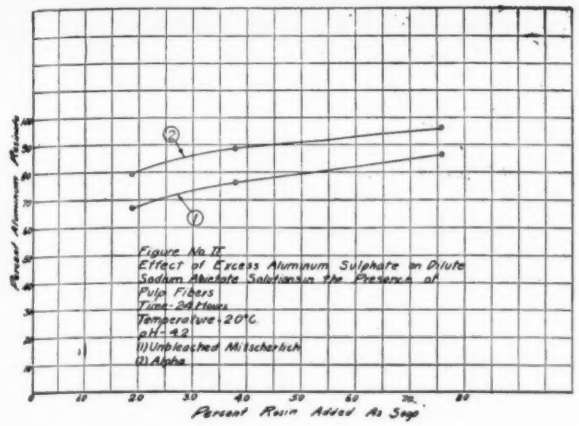


Figure No II
Effect of Excess Aluminum Sulphate on Dilute Sodium Abietate Solutions in the Presence of Pulp Fibers
Time: 24 Hours
Temperature 20°C.
pH 4.2
(1) Unbleached Mitscherlich
(2) Alpha
Percent Rosin Added As Soap

hydrolysed and that only the normal aluminum abietate is formed on the addition of aluminum sulphate.

Eight different pulps at consistencies of four per cent in the presence of three different concentrations of sodium abietate corresponding to 1.90, 3.79, and 7.58 per cent abietic acid on the bone dry basis of the pulp were treated with an excess of aluminum sulphate. Data in Table II, pages 26, 27, 28, and 29 shows that more aluminum sulphate was needed to produce the same pH in the presence of pulp than in the absence of pulp fibers. This was found to be especially true at the two lower concentrations of sodium abietate. The two kraft pulps required more aluminum sulphate than the other pulps. The pulps were allowed to stand in contact with the sodium abietate solutions for twenty-four hours at 20 deg. C. before adding the aluminum sulphate, in order to determine the effect of the pulp fibers. Bialkowsky *(4)* found that dilute sodium abietate solutions were hydrolysed as much as sixty per cent when allowed to stand in contact with pulp fibers. He found that the amount of hydrolysis depended upon the pulp used and attributed this phenomena to

$$C_{19}H_{29}COONa + HOH \overset{\text{Pulp Fibers}}{\rightleftarrows} NaOH + C_{19}H_{29}COOH$$

the ability of the cellulose fibers to reduce the alkalinity of the solution and force the hydrolysis of the sodium soap, thereby liberating colloidally free rosin. Since we could not expect a chemical reaction to take place between any liberated colloidal abietic acid and aluminum sulphate, the amount of aluminum abietate formed would be dependent upon the amount of the rosin still in the combined form as the sodium soap; the amount of free rosin formed would be dependent upon the degree to which the pulp fibers forced the hydrolysis of the sodium abietate. By extracting the rosin precipitates from the pulp fibers with chloroform and evaporating and ashing the rosin, the amount of Al_2O_3 can be determined. If the resin extract is corrected for the extract originally present in the pulp and converting the Al_2O_3 content found to aluminum abietate, the amount of free rosin can be calculated. From the data obtained, it can be seen that the pulp fibers force the hydrolysis of sodium abietate to some extent, and that free rosin as well as aluminum resinate is formed as a result of this hydrolysis; the amount of free rosin obtained varies with the concentration of sodium abietate and the pulp used. Curves on pages 40 and 41 show the effect of two pulps on three different concentrations of sodium abietate when allowed to stand in contact with the soap for twenty-four hours and then precipitated with an excess of aluminum sulphate. Since pulps alter the equilibria of sodium abietate and different pulps behave differently in the amount to which they change this equilibria, no two systems can be expected to be the same when pulp fibers are sized in the beater.

C. The Relative Ease of Sizing of Various Pulps in Relation to Their Behavior Toward Sodium Abietate and Aluminum Sulphate.

1. Methods of Procedure

Beater runs were made with the eight different pulps, duplicating as nearly as possible the system set up in studying the rosin precipitate in the presence of the various pulps, as shown in Tables I and II, pages 24, 26, 27, 28, and 29. The pulps were soaked in distilled water for forty-five minutes and then added to the beater and

TABLE II

EFFECT OF EXCESS ALUMINUM SULPHATE ON DILUTE SODIUM ABIETATE SOLUTIONS IN THE PRESENCE OF VARIOUS PULPS

Normality of NaAb	Ratio NaAb / $Al_2(SO_4)_3$	Per cent HAb on basis of pulp	Per cent $Al_2(SO_4)_3$ on basis of pulp	Weight of extract gms.	Weight of extract corr'd gms.	Weight of Ash gms.	Per cent Ash	Per cent Al(Ab)$_3$ based on extract	Per cent free HAb based on extract	Per cent Al(Ab)$_3$ based on pulp	Per cent free HAb based on pulp	pH filtrate
0.0100	1:3	7.58	4.28	0.7979	0.7798	0.0410	5.27	96.2	3.8	7.50	0.329	4.2
0.0050	1:4	3.79	2.85	0.4072	0.3891	0.0189	4.86	88.7	11.3	3.45	0.435	4.2
0.0025	1:6	1.90	2.14	0.2010	0.1829	0.0079	4.33	79.2	20.8	1.45	0.379	4.2
Blank Alpha	...	...	...	0.0181	.....	.....	...	...	...	...	.....	..
0.0100	1:3	7.58	4.28	0.8047	0.7857	0.0434	5.50	100.0	...	7.78	.....	4.2
0.0050	1:4	3.79	2.85	0.4062	0.3872	0.0214	5.52	100.9	...	3.90	.....	4.3
0.0025	1:6	1.90	2.14	0.2077	0.1887	0.0093	4.94	90.1	9.9	1.69	0.187	4.3
Blank Rag	...	...	...	0.0190	.....	.....	...	...	...	...	.....	..
0.0100	1:3	7.58	4.28	0.8658	0.7902	0.0410	5.20	95.0	5.0	7.50	0.402	4.2
0.0050	1:4	3.79	2.85	0.4735	0.3979	0.0190	4.79	87.4	12.6	3.48	0.499	4.2
0.0025	1:6	1.90	2.14	0.2608	0.1852	0.0084	4.52	82.8	17.2	1.53	0.364	4.2
Blank Bleached Sulphite	...	...	...	0.0756	.....	.....	...	...	...	...	.....	..
0.0100	1:3	7.58	4.28	0.8664	0.7671	0.0390	5.09	92.9	7.1	7.13	0.539	4.2
0.0050	1:4	3.79	2.85	0.4660	0.3667	0.0192	5.24	95.7	4.3	3.51	0.159	4.2
0.0025	1:6	1.90	2.14	0.2870	0.1877	0.0098	5.22	95.4	4.6	1.79	0.086	4.2
Blank Groundwood	...	...	...	0.0993	.....	.....	...	...	...	...	.....	..
0.0100	1:3	7.58	4.28	0.7910	0.7403	0.0350	4.76	86.3	13.7	6.40	0.988	4.2
0.0050	1:4	3.79	2.85	0.4207	0.3700	0.0155	4.19	76.5	23.5	2.83	0.869	4.2
0.0025	1:6	1.90	2.14	0.2450	0.1943	0.0072	3.68	67.2	32.8	1.31	0.636	4.2
Blank Unbleached Mitsch.	...	...	...	0.0507	.....	.....	...	...	...	...	.....	..
0.0100	1:3	7.58	4.28	0.8838	0.7800	0.0385	4.92	90.1	9.9	7.03	0.767	4.2
0.0050	1:4	3.79	2.85	0.4878	0.3840	0.0185	4.83	88.3	11.7	3.39	0.451	4.2
0.0025	1:6	1.90	2.14	0.2978	0.1940	0.0082	4.23	76.5	23.5	1.48	0.450	4.1
Blank Unbleached Sulphite	...	...	...	0.1038	.....	.....	...	...	...	...	.....	..
0.0100	1:3	7.58	4.28	0.7762	0.7703	0.0375	4.87	88.9	11.1	6.85	0.85	4.5
0.0050	1:4	3.79	2.85	0.3892	0.3833	0.0182	4.76	87.0	13.0	3.33	0.50	4.5
0.0025	1:6	1.90	2.14	0.1944	0.1885	0.0078	4.13	75.6	24.4	1.38	0.46	4.7
Blank Unbleached Kraft	...	...	...	0.0059	.....	.....	...	...	...	...	.....	..
0.0100	1:3	7.58	4.28	0.7549	0.7510	0.0341	4.54	82.9	17.1	6.23	1.28	4.5
0.0050	1:48	3.79	3.42	0.3879	0.3840	0.0123	3.21	58.5	41.5	2.25	1.60	4.4
0.0025	1:8	1.90	2.85	0.1815	0.1776	0.0055	3.10	56.0	44.0	0.995	0.78	4.5
Blank Semi-Bleached Kraft	...	...	...	0.0039	.....	.....	...	...	...	...	.....	..

slushed for five minutes. The weights were then added to the lever arm and the pulps were beaten at a consistency of two per cent in distilled water. Two percent sodium abietate on the oven-dry basis of the stock was added to the beater at the beginning of the run. The stocks were all beaten to approximately the same freeness. The weights were removed and sufficient C. P. $Al_2(SO_4)_3 \cdot 18H_2O$ was then added to give a pH of 4.5. The stock was then slushed around for five minutes to insure good mixing. Hand sheets were made to weigh approximately 36 pounds on the 24 x 36 x 480 basis. The sheets were all made under identical conditions; they were all made at the same consistency, pressed at 100 pounds per square inch for one minute, and dried in an electric dryer for exactly ten minutes at 105 deg. C. All of the sheets, before testing, were conditioned in the humidity room at 65 degrees relative humidity and 70 deg. F. The sheets were trimmed down to 5 x 5 inches, thickness measured, basis weight taken, porosity measurements made and the Valley Currier, Carson curl and dry indicator tests made on the various sheets. Duplicate beater runs were made on the same eight pulps under exactly the same conditions except that tap water, commercial rosin size (30 per cent free) and paper makers alum were used. The sheets were tested under the same conditions as in the above procedure. The data as shown in Tables III, IV, V, VI, VII, VIII, and IX are average values obtained by testing a large number of samples.

2. Tests and Apparatus

Size tests made on handsheets by means of the Valley size tester, the Currier size tester, the Carson curl size tester, and by means of the dry indicator method as described in TAPPI standards. Porosity measurements were made with the Gurley densometer. The hydrogen ion concentrations were measured by means of the LaMotte colorimetric pH set. Soxhlet extractors with ground glass joints were used for all extraction work. The samples were placed in extraction thimbles that were fat free. Platinum dishes were used for all evaporations and ignitions, and an electric muffle furnace was used for ashing. Beater runs were made in a one pound Valley Iron Works beater and the hand sheets were dried in a Williams electric dryer controlled at 105 deg. C.

3 Data

Beater runs were made in distilled water with eight different pulps to determine their relative ease of sizability when made under the same conditions. Two per cent sodium abietate and sufficient alum to produce a pH of 4.5 were used. Four different size tests were made on samples of hand sheets. Table III gives the results of size tests as well as other tests made on the hand sheets.

TABLE III
RELATIVE SIZABILITY OF VARIOUS PULPS

Type of Pulp	Final pulp freeness	Weight 5"x5" sheet gms.	Thickness inches	Porosity 100 c.c. sec.	Valley test sec.	Currier test sec.	Dry indicator test sec.	Carson curl sec.
Groundwood	260	0.86	0.0052	16	42	101	32	11
Unbleached Kraft	370	1.14	0.0042	214	21	45	67	58
Unbl. Mitsch....	390	1.04	0.0037	162	14	26	44	29
Unbl. Sulphite...	385	0.94	0.0031	183	13	19	62	15
Semi Bl. Kraft..	370	1.05	0.0038	206	21	50	75	42
Bleached Sulphite	360	1.05	0.0035	345	15	29	46	25
Alpha	390	1.02	0.0039	81	18	31	43	20
Rag	370	1.04	0.0044	75	4	7	15	10

Size tests listed in Table IV indicate the relative ease of sizing various pulps. The beater runs were made in tap water under the same conditions. Two percent rosin size (30 per cent free) and sufficient alum to produce a pH of 4.5 were used. Three different size tests were made on samples of hand sheets.

TABLE IV
RELATIVE SIZABILITY OF VARIOUS PULPS

Type of Pulp	Final pulp freeness	Weight 5"x5" sheet gms.	Thickness inches	Porosity 100 c.c. sec.	Valley size sec.	Currier size sec.	Dry indicator test sec.
Groundwood	200	0.78	0.0063	9	25	96	34
Unbleached Kraft...	290	1.08	0.0040	167	17	44	59
Unbl. Mitscherlich..	320	1.03	0.0042	220	12	31	55
Unbleached Sulphite.	340	0.96	.....	...	17	34	40
Semi Bleached Kraft	330	0.91	0.0034	97	14	30	41
Bleached Sulphite...	290	1.02	0.0039	158	13	33	57
Alpha	360	0.96	0.0037	98	16	34	42
Rag	240	0.94	0.0038	111	5	15	21

Table V compares the percent of sodium abietate hydrolysed as obtained in Table II, with the size tests of the various pulps as obtained in Table III.

TABLE V
EFFECT OF FREE ROSIN ON SIZE TESTS OF VARIOUS PULPS

Type of Pulp	Valley size test sec.	Currier size test sec.	Dry indicator size test sec.	Carson curl test sec.	Per cent NaAb hydrolysis
Groundwood	42	101	32	11	4.6
Unbleached Kraft.....	21	45	67	58	24.4
Unbleached Mitscherlich	14	26	44	29	32.8
Unbleached Sulphite...	13	19	62	15	23.5
Semi Bleached Kraft..	21	50	75	42	44.0
Bleached Sulphite.....	15	29	46	25	17.2
Alpha	18	31	43	20	20.8
Rag	4	7	15	10	9.9

The effect of two different rosin sizes on size tests are compared in Table VI as obtained from hand sheets made from beater runs listed in Table III, and Table IV.

TABLE VI
EFFECT OF ROSINS ON SIZE TESTS OF VARIOUS PULPS

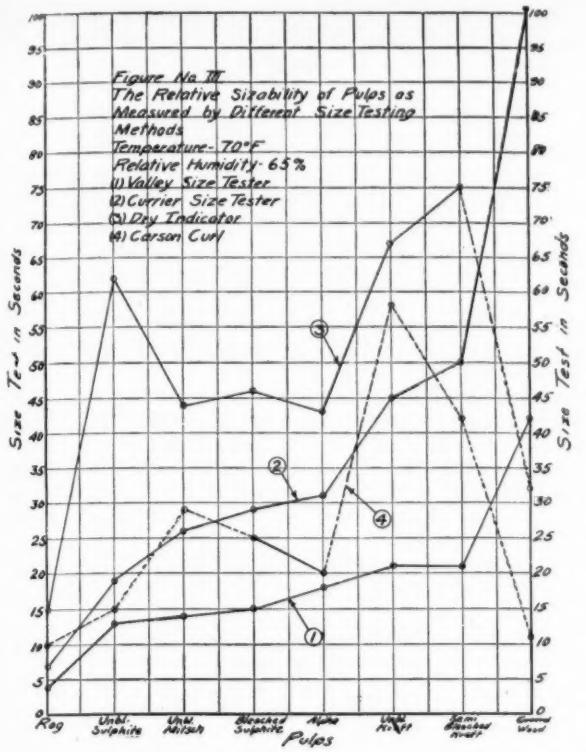
	Sodium Abietate			Commercial Rosin Size (30 per cent free)		
Type of Pulp	Valley size test sec.	Currier size test sec.	Dry indicator size test sec.	Valley size test sec.	Currier size test sec.	Dry indicator size test sec.
Groundwood	42	101	32	25	96	34
Unbleached Kraft..	21	45	67	17	44	59
Unbl. Mitscherlich..	14	26	44	12	31	55
Unbleached Sulphite	13	19	62	17	34	34
Semi Bl. Kraft.....	21	50	75	14	30	41
Bleached Sulphite..	15	29	46	13	33	57
Alpha	18	31	43	16	34	42
Rag	4	7	15	5	15	21

5. Discussion

In the preceding sections of this investigation it was found that pulp fibers altered the system set up in the process of resin sizing. Instead of obtaining only the normal aluminum abietate as was found to be the case in the absence of fibers, free abietic acid as well as aluminum abietate was found in the rosin precipitate. The relative amounts of free and combined rosin varied with the individual pulp. It is a well known fact that in mill practice it is often more difficult to size certain types of pulps than others. In view of these two facts, beater runs were made on the same pulps that were used in Table II, in order to determine whether any correlations existed between the relative amounts of free and combined rosin present in the pulps and the relative ease of sizing of these pulp fibers.

a. *Relative Sizability of Various Pulps*

In Tables III and IV are given the results obtained by making size tests on hand sheets made from beater runs on eight different pulps. The stocks were all beaten to approximately the same freeness and the hand sheets in all cases were made under exactly the same conditions. It can be seen that the relative degree of sizing of any one pulp as compared to another may vary depending upon the size test used: this is more or less an established fact in mill practice. In comparing the Valley size test of groundwood with unbleached kraft, the groundwood test is higher while the reverse is true when the dry indicator test is used.



b. *Effect of Free Rosin on Size Tests of Various Pulps*

In Table V is shown the size test data on beater runs from eight different pulps as compared to the amount of hydrolysis of the sodium abietate solutions in the presence of these pulps; the degree of hydrolysis being measured by the amount of free abietic acid found. The beater runs were carried out under identical conditions with those used in studying the equilibria of the sodium abietate solutions in the presence of pulp fibers. The same type of system was set up in all cases; namely, sodium abietate, aluminum sulphate, distilled water, and pulp fibers. There appears to be no definite correlation between any one size test and the extent to which the sodium abietate undergoes hydrolysis when the different pulps are compared with each other. No single size test employed gives results comparable with the relative quantities of free and combined rosin present in the sheet.

c. *Effect of Rosins on Size Tests of Various Pulps*

Table VI compares size tests on hand sheets made from beater runs of eight different pulps under standard conditions using two per cent sodium abietate in one set and two per cent commercial rosin size (30 per cent free) in the other. There appears to be no definite advantage in using a highly purified rosin size such as sodium abietate. The commercial size, which is only partly saponified, gives no better size tests than the fully saponified sodium abietate.

From the results obtained in Tables III, IV, V, and VI, no definite advantages can be given to either free rosin or aluminum resinate as the true sizing agent. However, this may be due to the failure of the size test employed to actually measure the true degree of sizing. Since a great many of the investigators in this field disagree as to the relative merits of free rosin and aluminum resinate as sizing agents, it may be assumed that some of these disagreements are the result of different size testing methods being used by the various workers.

D. The Effect of Drying Temperature and Rosin Retention on the Sizability of a Given Pulp.

1. Method of Procedure

Hand sheets from beater runs, shown in Table III, were made under identical conditions; part of the sheets were dried at 105 deg. C. for ten minutes and part were air dried. Sufficient air dried sheets were cut up into small pieces and extracted with chloroform in a Soxhlet extractor in order to determine the percentage of rosin retained in the hand sheets. Samples of air dried and electrically dried sheets were seasoned in the humidity room at 70 deg. F. and 65 per cent relative humidity and then tested for their degree of sizing by means of different size tests.

2. Data

Hand sheets from beater runs, in Table III., under identical conditions, were air dried and dried at 105 deg. C. for ten minutes. Samples of these sheets were tested for degree of sizing by four different size tests. The results are shown in Table VII.

TABLE VII
EFFECT OF DRYING TEMPERATURE ON SIZE TESTS

	Dried at 105 deg. C.				Air dried			
Type of pulp	Valley size test sec.	Currier size test sec.	Dry indicator test sec.	Carson curl test sec.	Valley size test sec.	Currier size test sec.	Dry indicator test sec.	Carson curl test sec.
Groundwood	42	101	32	11	15min.+	15min.+	70	..
Unbl. Kraft	21	45	67	58	18	35	130	..
Un.Mitschlerlich	14	26	44	29	17	37	93	..
Unbl. Sulphite	13	19	62	15	12	24	70	19
Semi Bl. Kraft	21	50	75	42	21	48	134	..
Bl. Sulphite	15	29	46	25	14	35	110	..
Alpha	18	31	43	20	18	33	106	..
Rag	4	7	15	10	9	18	56	..

Air dried sheets, from beater runs, in Table III were extracted with chloroform to determine the per cent rosin retention of the various pulp fibers. Table VIII gives the retention figures for eight different pulps.

TABLE VIII
EFFECT OF VARIOUS PULP FIBERS ON THE RETENTION OF ROSIN

Type of Pulp	Per cent rosin added	Per cent rosin found	Per cent rosin blank	Per cent rosin corr'd	Per cent retention
Groundwood	2.00	2.37	0.99	1.38	69.0
Unbleached Kraft	2.00	1.77	0.059	1.18	59.0
Unbleached Mitscherlich	2.00	1.587	0.507	1.08	54.0
Unbleached Sulphite	2.00	1.978	1.038	0.94	47.0
Semi Bleached Kraft	2.00	1.359	0.039	1.32	66.0
Bleached Sulphite	2.00	1.736	0.756	0.98	49.0
Alpha	2.00	1.231	0.181	1.05	52.5
Rag	2.00	1.54	0.190	1.35	67.5

Table IX compares the rosin retention as obtained in Table VIII, with the four size tests as obtained in beater runs made in Table III.

TABLE IX
EFFECT OF ROSIN RETENTIONS ON THE SIZE TESTS OF VARIOUS PULPS

Type of Pulp	Per cent retention	Valley size test sec.	Currier size test sec.	Dry indicator test sec.	Carson curl test sec.
Groundwood	69.0	42	101	32	11
Unbleached Kraft	59.0	21	45	67	58
Unbleached Mitscherlich	54.0	14	26	44	29
Unbleached Sulphite	47.0	13	19	62	15
Semi Bleached Kraft	66.0	21	50	75	42
Bleached Sulphite	49.0	15	29	46	25
Alpha	52.5	18	31	43	20
Rag	67.5	4	7	15	10

3. Discussion

a. *Effect of Drier Temperature on Size Tests*

The fact that aluminum resinate is said to undergo decomposition by some investigators when dried at temperatures approximately that of the drier sections, and that this claim was confirmed in the present work, led to the following series of tests.

Size tests are shown in Table VII, of hand sheets made from beater runs of eight different stocks sized with two per cent sodium abietate and sufficient alum to produce a pH of 4.5. The size tests of air dried sheets and sheets dried at 105 deg. C. for ten minutes are compared and in most cases the air dried sheets give better size tests.

Since it was found that aluminum abietate partially decomposes at temperatures existing on the driers and that aluminum resinate present in the sheet was decomposed at least in part in passing through the drier sections, the effect of this decomposition was investigated in relation to sizing results. This decomposition appears neither to help nor hinder the size tests since sheets dried at 105 deg. C. are in no way superior to air dried sheets in this respect. This would not seem to support the theory of some workers in this field that a continuous film is necessary for good sizing, and that this film is produced on the driers.

Since no correlations were obtained between the composition of the rosin precipitate and the relative ease of sizing of the various pulps as measured by four different size tests, the retention of rosin by the various pulps was determined and compared with size tests of these pulps.

b. *Effect of Various Pulp Fibers on the Retention of Rosin*

Retention figures in Table VIII, obtained by extracting air dried sheets with chloroform show that in making hand sheets between 45 and 70 per cent of the rosin is retained in the sheet when two per cent sodium abietate and sufficient alum to produce a pH of 4.5 is used. The per cent retention did not vary greatly between two extremely different paper fibers such as groundwood and rag.

c. *Effect of Rosin Retentions on the Size Tests of Various Pulps*

A comparison of the different size tests and retentions by the various pulps as obtained in Table IX, shows that a higher rosin retention by one pulp as compared with another does not necessarily mean a superior size test for that pulp. Although rag has a higher rosin retention than some of the wood pulps, the size tests show a poorer sized sheet for rag. This also holds true when two different types of wood pulps are compared.

In mill practice intermittent sizing difficulties are often encountered, even though the same quality and quantity of size, stock, and other materials are the same. When the poorly sized sheets are analyzed for rosin, the retention is found to be just as good as the well sized sheets. This would indicate that particle size or distribution is an important factor in obtaining a well sized sheet.

Conclusions

In this investigation it is concluded that:

1. Hand sheets that have been air dried or dried at a low temperature and paper that has not passed through the drier sections can be extracted for its total rosin content by means of a dry neutral solvent such as chloroform.

2. Drying temperatures as encountered by paper passing through the dryer sections are sufficient to decompose at least part of the aluminum resinate in the sheet. It is probable that part of the aluminum resinate is decomposed into basic aluminum resinates which are insoluble in chloroform making it necessary to use some other type of solvent for extraction.

3. It has been found that a precipitate of neutral aluminum abietate is formed from the interaction of an excess of aluminum sulphate with dilute sodium abietate. When pulp fibers are added to the system, however, the hydrolysis of a portion of the sodium abietate is forced as a result of the selective adsorption of alkali by the fibers, and free abietic acid is precipitated on the fibers along with neutral aluminum abietate. Various pulps behave differently in the extent to which they force the hydrolysis of sodium abietate.

4. Pulps arranged according to their relative ease of sizability as measured by one size testing method will fall in a different order when a different size testing method is used. Two different pulps may give entirely different relative degrees of sizing, depending on which size test was used.

5. The relative amounts of free rosin and aluminum resinate formed in the sheet is controlled to a large extent by the character of the pulp and its action on sodium resinate; but none of the currently used tests for the degree of sizing give relative sizabilities that are related with the quantity or relative amount of either free abietic acid or normal aluminum abietate.

6. Sized hand sheets dried at 150 deg. C. do not give better size tests than the same air dried sheets. In many cases the air dried sheets give higher size tests.

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Forecasting Paper Production*

By Louis T. Stevenson, D.C.S.[1]

Efficient production control is based on accurate forecasts of the demands to be made upon raw materials, supplies, and equipment. The better the forecast, the easier the production control job.

A good forecast for the purposes of production control is composed of three main elements:

1. General business conditions.
2. Business conditions in the particular industry.
3. The particular business of the producer in question.

General business conditions were discussed last February *(1)* in their broad relation to the production of paper in the United States. A method for determining the current phase of the business cycle and of the general paper production cycle was suggested. It is here proposed to extend that study somewhat further. Indications of the turns of these cycles will be considered. Two important branches of the United States paper industry will then be studied in order to ascertain whether their behavior conforms to that of the United States paper industry as a whole.

It is believed that a mill management, when equipped with a broad knowledge and understanding of these movements will be able to develop a satisfactory production forecast from its own records and the particular business information which it must possess.

In the manufacture of paper in an integrated mill, the time that elapses from cutting the tree until the fibre leaves the mill embodied in a sheet of paper is frequently a year or more. This long cycle of production offers many opportunities for errors in anticipating production requirements.

Production management in the paper industry is thus vitally interested in securing as early and accurate forecasts as possible.

Limits of Accuracy

Every scientific observation has some limits as to accuracy. These limits are generally known and accepted. When dealing with materials, the chemist is dealing with non-sentient units. The economist has to deal with sentient and wilfull units, each one capable of changing his habits and actions. There are, however, certain similarities of human behavior upon which the economist can reasonably depend "other things being equal." That last clause is, unfortunately, necessary in the statement of any economic law. Thus economic analysis has greater areas of uncertainty in its findings than have the exact sciences, such as physics and chemistry.

The behavior of human beings in the exercise of their preferences for goods and services is the basis of all economic demands. Forecasting those demands is, therefore, subject to a rather wide range of error. This should be recognized and statements in this presentation are made with this qualification.

Should attempts at forecasting be abandoned because of this limitation? In our roundabout economy, it is absolutely necessary for the producer to forecast. So why should he not avail himself of scientific analysis, maintaining a properly scientific approach by recognizing the limits of accuracy in the work?

Economic Bases

It may be well to recall at this point some of our elementary economics.

Our present economy is based on individual property rights, division of labor, freedom of contract and free exchange functioning through the medium of money. The producer makes a great deal more of a product than he can possibly consume. He exchanges his surplus with others for portions of their surpluses using money as a medium of exchange. This process, of necessity, involves an anticipation of the probable volume of his own product that can be disposed of to his fellow men.

The business man is thus functionally engaged in anticipating both the demands for goods and the relation of these demands to supply factors for these goods. Forecasting is one of his prime functions. He does much of it instinctively or automatically, based on his own past experience.

Demand has been defined as "desire to buy and will to buy backed by purchasing power." *(2)* This has sometimes been abbreviated to—"demand equals desire plus ability to pay."

Desire is subjective. Its origin is mental. It is expressed in individual choices as between different goods or services. It becomes effective when coupled with ability to pay.

Ability to pay, in the long run, arises out of the production of goods that are both scarce and wanted by others, i.e., exchangable for other goods.

Anticipating demands thus involves anticipating human desires and human abilities to pay.

The Problem

The problem of the forecaster for an industrial concern thus reduces to

1. Determining the probable choices of the masses of individuals for the particular product under consideration. This is sometimes called "consumer acceptance."
2. Determining the probable trend of general production and its effect on the ability to pay of the probable consumers of the particular product under consideration.

Consumer acceptance of a particular product should be determined by a market analysis for the product. This is a highly specialized field and it will not be discussed here. It is a step which should not be neglected by the individual mill for its individual products. It should determine for the individual product the "desire" part of the equation—Desire plus ability to pay equal demand.

In our economy, production becomes effective as "ability to pay" or "purchasing power" through the sale of a product for money. The business man passes shares of the money income back to the factors that made the product. This process is subject to a number of maladjustments such as inflation or deflation of the medium of exchange, or maldistribution of the shares among the factors of production due to governmental interference with economic processes, attempts at monopoly, etc. *(3)* Maladjustments should be carefully considered by the forecaster as they are frequently major factors in the business cycle. *(4)*

General Production

In the United States production may be classified as follows:

1. Industrial
   a. Manufacturing
   b. Mining
2. Agricultural
3. Mercantile
4. Services

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[1] Member TAPPI, Manufacturers Representative, New York, N. Y.

The physical volume of industrial production and that of agricultural production can be measured with reasonable accuracy. Mercantile production is engaged in handling and distributing the physical product of the other two. Services depend for their income upon the product of the other three categories.

So far as the paper industry in the United States is concerned, it has been found that total paper production moves with industrial production after allowing for long time trend and for seasonal variation in each series. *(5)*

The problem, thus, is to determine if possible, the probable course of industrial production on the hypothesis that by so doing the probable course of total Paper Production will be determined.

Dominant Factors Vary

Of the many factors affecting the course of the business cycle, different ones seem to dominate at different times. The dominating factors should be sought out, analyzed and watched carefully. For example, the 1921 depression was brought about by the collapse of high wartime prices, while a major factor in the 1929-32-33 debacle was the world banking and credit situation, especially that in the United States. The current upswing of the business cycle is characterized by artificially low money rates, an accumulated demand for goods and a lavish expenditure of Government funds. The budget deficit compels the Federal Government to borrow. The Treasury Department manipulates the excess reserves of the member banks in order to maintain low money rates. Although money rates are low, confidence has not entirely returned. *(6)* Many investors are unwilling to make large outlays for durable capital goods. The fear of uncontrolled inflation is also given prominence by many. Developments of these fundamental factors should be watched closely because changes in them will greatly affect the course of the business cycle, industrial production, and paper production.

Price Movements

Bearing all this in mind, it may be useful to study in detail some of the factors affecting industrial production.

The profit motive is still the dominant force behind business moves. Profits result, speaking in business terms, when unit prices are above the unit cost of production. It is therefore logical to look at price movements as possible causal factors in the movements of industrial production. *(7)*

There are, however, two kinds of price movements. In one the monetary factor remains relatively stable and supply factors for the goods operate against demand factors to cause fluctuations in prices. In the other kind, fluctuations in the monetary factor itself are woven among the supply and demand factors.

In the first or "normal" condition, where the monetary factor remains stable, an advance in price is usually the result of an increased demand operating against a stable flow of the article or a diminished flow of the article operating against a stable or rising demand. A drop in price is, of course, the result of reversing these situations.

Price changes are the governors of our economic system. If the price for an article advances, it tends to increase the profit in producing that article. This attracts additional suppliers which tends to increase the production of that article. So under normal conditions an advance in price usually leads to an increase in production and a fall in price leads to a decrease in production.

When changes in the monetary factor take place, those normal movements are distorted by inflationary and deflationary reactions. The term "monetary factor" is used here in the broad sense and thus includes both currency and bank credit when used as a medium of exchange.

Chart I. Description

In Chart I is shown Bradstreet's Price Index converted to a relative. The average of 1923 to 1925 is taken as 100. Above the price index on this same chart will be found the Federal Reserve Board's Index of Industrial Production adjusted for seasonal variation. Below it will be found a chart showing new machine tool orders.

Machine tools are, of course, used in making durable capital goods and durable consumer's goods. It has been shown that these latter are "the goods in which a shrinkage of income causes heaviest contraction of expenditure." *(8)* Recent studies tend to show that a major part of the responsibility for the Business Cycle focuses in the durable goods industries. *(9)* Machine Tool Orders, therefore, should, and normally do, anticipate a decline in Industrial Production.

Chart I. Analyzed

Let us now proceed to an analysis of the movements illustrated by the Chart I. For the purposes of comparison and analysis a number of points on the charts have been lettered. Point A on Industrial Production is thought to correspond with A^1 on the Price Chart and A^2 on the Machine Tool Orders Chart. Point B on Industrial Production similarly has corresponding points on the other two charts and so on.

Recovery

From Point A through G that is from 1921 through 1927 the movements may fairly be said to be orderly. Prices generally lead the movements in production. Machine tool orders reached their peaks about the same time as prices and therefore lead industrial production. The same type of lead is not developed by Machine Tool Orders on the upgrade during this period.

This period may be called one of normal recovery where "natural" forces are in action.

Credit Inflation Boom

During 1927 the New York Federal Reserve Bank undertook open market operations with the objective of keeping money rates low in the United States and to promote world stability by helping the Bank of England retain a gold standard. However, an inflationary movement in the securities markets developed. Although the commodity price level was falling and "profitless prosperity" developed, Industrial Production and Machine Tool Orders soared to meet extra demands created by installment buying and the inflation in the securities markets. The productive capacity was adequate so that no rise in prices ensued. In fact prices declined steadily during the period from 1927-1929.

Crisis of 1929

Here we come to the crucial points of the boom, namely, Points H and I. We find no inkling of the impending crisis in the action of the Price Index save that the mere lack of startling movement should have made us realize that something was wrong. However, we do find the peak of Industrial Production anticipated by Machine Tool Orders by a four month period. Industrial production in turn, anticipated the great stock market decline by four months. *(10)*

Recession

The great decline had started. The banks of the country had become over extended on security loans. These had to be liquidated. Commodity prices all over the world were declining. Country after country restricted imports, established exchange controls and generally resorted to ec-

onomic nationalism. After the break at Point I in 1929 and at Point K early in 1930 a short stabilizing period developed in production, but prices continued downward and pulled production with them.

Depression Low

The world situation finally became liquidated about 1932. Prices touched bottom and started up. But in the United States it was an election year and the banking situation was very shaky. Many banks had security and real estate loans that were "under water." Those who knew of the situation were fearful of the result of an untoward incident. This was provided by the rash of statewide bank holidays which broke out and eventually ended in the closing of all the banks. Point M coincided with the inauguration of the present administration.

Recovery

Here again prices anticipated production by moving up a month ahead of it.

The natural forces of recovery, added to the announced administration policies were the causes operating to develop the peak of 1933 at N. Since the advent of the present administration the government has taken numerous steps to affect business. Free enterprise has to a certain extent, been curtailed. Hence we do not find the three graphs recording normal relationships.

Production and machine tool orders have fluctuated widely. Prices at first advanced sharply with production but showed little fluctuation thereafter other than a general drift or trend upward until the first of this year. The NRA and the AAA had then been abolished by the Supreme Court.

After the first or "inflationary peak" in 1933 machine tool orders seem to have anticipated both the peaks and the lows of industrial production.

Conclusions

The conclusions that seem to develop from this analysis are:

1. During periods when natural economic forces operate, prices as shown by the Bradstreet Index, tend to precede slightly, both up and down movements of industrial production.

2. During periods when natural economic forces are interfered with, either by manipulation of the credit base and/or by governmental interference in business, new orders for Machine Tools tend to precede Industrial Production in declining from the peaks and to coincide with or anticipate Industrial Production at the lows of the movements.

This analysis is offered as an application of theoretical economics to the business man's problem of anticipating movements in demand and supply factors. It is believed that it can be applied in a satisfactory manner by one familiar with current economic movements. The major moves in industrial production are thus subject to some degree of anticipation.

The Individual Mill

The individual manufacturer may agree, but still not be satisfied that he is getting what he needs. He needs to know how *his* business is going to be affected. This may be partially satisfied by an analysis of the behavior of his branch of the industry as compared with the industry as a whole.

Statistical Difficulties

Here some difficulties of classification develop. The in-

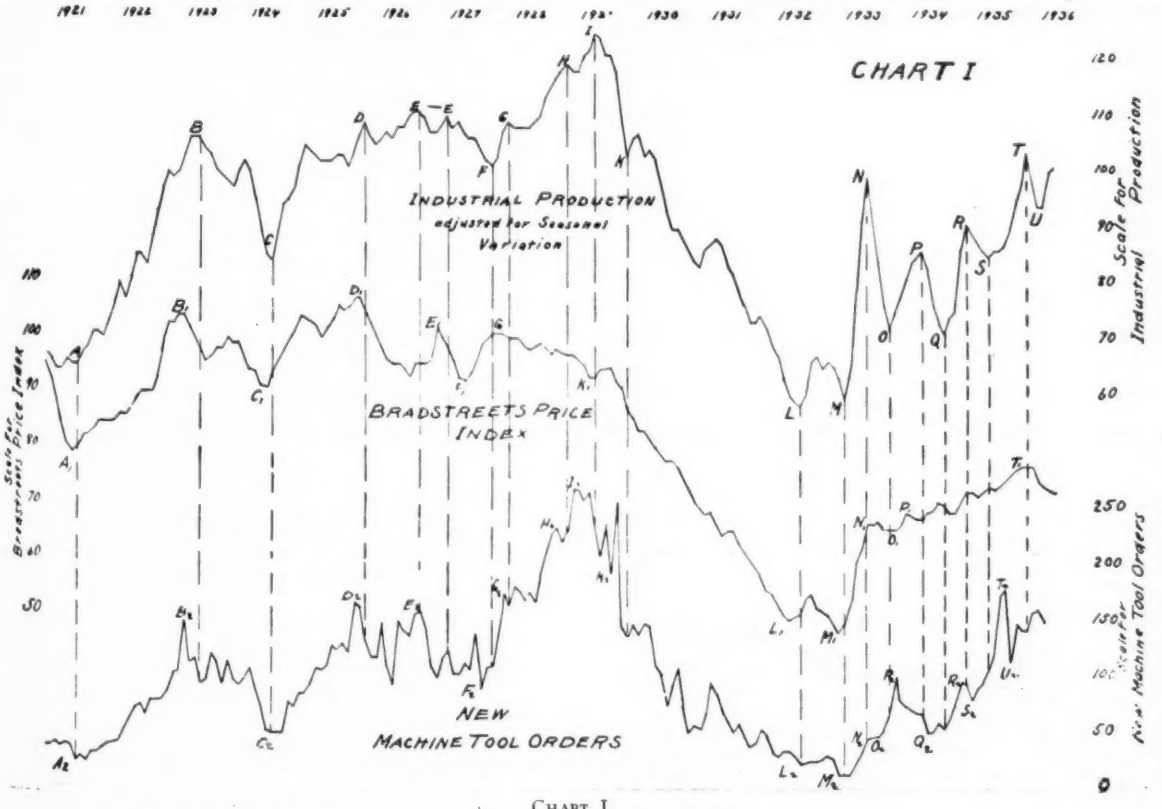
CHART I
INDUSTRIAL PRODUCTION
adjusted for Seasonal Variation
BRADSTREET'S PRICE INDEX
NEW MACHINE TOOL ORDERS
Scale for Industrial Production
Scale for Bradstreet's Price Index
Scale for New Machine Tool Orders
1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936

Chart I

This chart 1921-1936 shows: I Industrial production, adjusted for seasonal variation (scale upper right); II Bradstreet's price index (scale left); III New machine tool orders (scale lower right). 1923-1925 average equals 100 on all graphs. Sources: Graph I, Federal Reserve Bulletin; Graph II, Dun & Bradstreet Co., Graph III, Survey of Current Business.

dustry generally uses main classifications that are rather broad. Some of the mills in a broad classification may be making products that do not move with the main products of the group. New products are constantly developed. The statistical organization of the industry changes from time to time. Associations come and go. The statistical continuity is interrupted. The result is, that there are few statistical series for the branches of paper manufacturing that extend over a long enough period to give satisfactory results from statistical analysis. News, board and writing are probably the best of the groups in that respect.

There is great need for statistical continuity. A series that has been gathered over an extended period should not be altered without good reason, and if possible, the old series should be maintained as well as the new series.

Comparison of Specific Branches

Chart II illustrates paperboard and newsprint production in the United States as shown with United States total paper production. By observing the variations among these series, the relation of the branch industry to the industry as a whole may be developed.

Up to 1926 both board and newsprint production were generally increasing in volume. Subsequent to 1926 imports of newsprint, principally from Canada, began to replace United States newsprint although newsprint consumption in the States continued to increase rapidly until 1929. Production of newsprint in the United States however, declined gradually until 1933 when it seemed to stabilize at about 65 on the chart.

Board on the other hand, has continued its upward trend. Fluctuations coincide closely with those of total paper production and thus also with industrial production. The long time trend of board production is distinctly upward, sharper even than total paper production. But changes in direction follow both total paper and industrial production.

The economic forces that are governing newsprint production in the United States are different from those affecting board production. Therefore, the behavior of the two series is different.

Board follows total paper production while news has remained almost stationary during three years of movement in the other series.

Conclusions

It is plain that

1. Board production has a sharply increasing long time trend.
2. Board production follows closely the moves of total paper production and those of industrial production.
3. By anticipating moves in Industrial production we should anticipate moves in board production.
4. Newsprint production under present conditions in the United States, has stabilized and does not move with total paper production and board production.

From the above analysis may be seen that production in different branches of the paper industry behaves differently. Where it is possible to ascertain these differences the knowledge is very useful to the forecaster.

Results and Possibilities

The forecaster for production control purposes thus will have:

(a) A good idea about the probable future of general business conditions.
(b) A knowledge of the relation of his industry to general business conditions.
(c) A knowledge of the relation that his branch of the industry bears to the industry as a whole.

By combining this knowledge with the data and estimates obtainable from his own organization records, a reasonably accurate forecast for production control is possible.

In closing may I enter a plea for more and better statistical information on the Paper industry. Present and past association executives and statisticians have done excellent work. Those that have been successful in obtaining the support of their membership have developed excellent statistical services, among these the writing, news and board divisions have probably the best statistical series. These series extend over a fairly long period and are good in all respects. Many of the other divisions are doing excellent work now but their statistical series are generally too short for developing significant analytical results.

The paper manufacturer owes much to his trade association. He should support it, not only financially but by sending in his statistical reports promptly. Thus he will obtain prompt and reliable information on which he can plan, accurately, his own production control.

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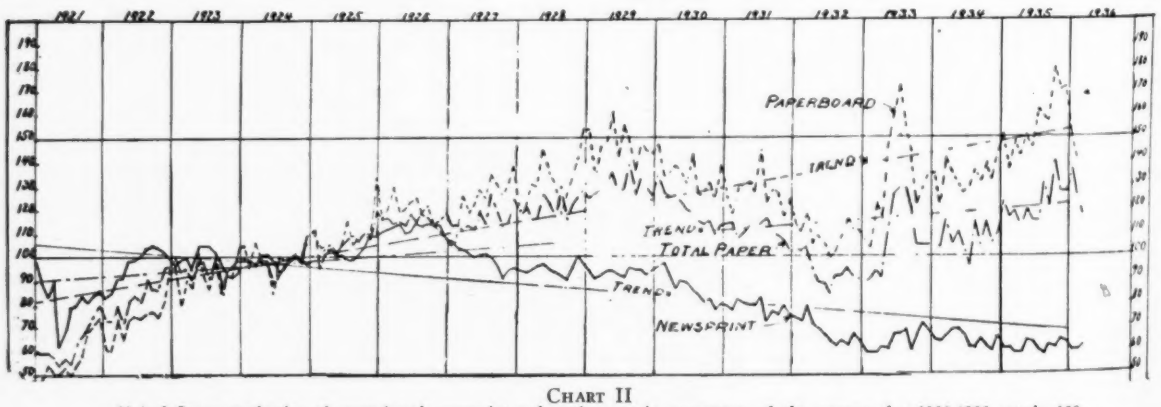

CHART II

United States production of paper board, newsprint and total paper in percentage of the average for 1923-1925 equals 100, each adjusted for seasonal variation, for 1921-1936. Sources: Federal Reserve Bulletin for Newsprint, Survey of Current Business for Paperboard and Total Paper.

Developments in the Manufacture of Coated Paper*

By O. W. Callighan[1]

Abstract

We have attempted to list below outstanding developments in the field of coated paper that have come to the attention of the members of the Coating Committee of TAPPI.

The equipment field offers the new air-gun coating machine as developed by the S. D. Warren Co., and made by the Merrill organization of Portland, Maine. This coater can be used in connection with the festoon system of rack drying or with the tunnel method. Greater speeds can be obtained using the latter and with this recirculating air system speeds of as high as 800 f.p.m. have been obtained with weights varying from 3 up to 20 pounds per side. With the tunnel system one naturally gets a faster setting of color, also closer control.

Reversible roll type coaters are being installed in a number of mills throughout the industry, and good results are being obtained or expected from this equipment. These machines are often equipped with brushes after the rolls as more or less a safety factor to insure uniform spreading of the color, etc.

Double coaters have been improved in construction to eliminate numerous sore spots. This has been made possible through long periods of continual operation.

The reflex system of drying, where a larger circulation of air is obtained with minimum size installation and operation, is being used successfully. This controls both air and humidity, which is somewhat different than other drying processes.

Several coating mills are making general improvements in their coating equipment such as removing vibration, speeding up, reducing waste due to mechanical deficiencies.

Pebble mills have been gaining in popularity and considerable literature has been published regarding their use and advantages over regular tank mixers. It is certain that they do a good job but that there is still considerable room for improvement.

One mill working with extremely viscous coating color for roll application to paper is obtaining excellent results with the use of ink machines to aid in making-down their color.

There have been various arguments by the manufacturers of colloidal machines outlining the advisability of their use in conjunction with the regular type color mixing tanks, ball mills, etc. They offer distinct advantages over anything so far developed for completely making down a coating color solution.

There has been a much wider use of screens in preparing good coating color in recent months and emphasis is placed on multiple screening in series rather than single screening.

Carbonates seem to be creating considerable interest in the coating field, especially those requiring minimum amounts of adhesives. Generally particle size governs the percentage of sizing material necessary to give a certain bond but it does not always hold true in the case of carbonate. Carbonate requiring less adhesive naturally produces the brightest coating so that nearly all the mills are concentrating on this type of carbonate. Various materials can be added to carbonate to lower its sizeability but the cost of these materials prohibits their extensive use.

High brightness coating clays are being produced that require minimum casein and that will finish up dull or to a high glare. Their use as substitutes for more expensive pigments is gradually increasing.

Starch now can be used in place of casein pound for pound. Developments of processes to waterproof starch are claimed but still remain to be proven. Starch is now treated so as to remove the iodine test, which should build up a very large field for this material. Prices of other adhesive materials continue to move upwards so that substitutes such as starch, soya bean, and other materials are being given serious consideration.

Before concluding, mention should be made of the development of papers treated by a filming process on the paper machine. Definite steps towards perfection have been made and it has opened a new field that heretofore was never touched by groundwood papers. One thing must be kept in mind however, and that is that the printability of these filmed papers is not quite up to that of high grade super calendered papers and they do not as yet begin to approach regular coated papers.

* Presented at the International Technical Meeting of the Technical Association of the Pulp and Paper Industry and the Technical Section of the Canadian Pulp and Paper Association, Montreal, P. Q., August 3-7, 1936.

[1] Member TAPPI, Edgar Bros. Co., New York, N. Y.

Trade Agreements in French Paper Industry

Efforts have been made recently with some success to organize the French paper industry, according to a report to the Commerce Department from Assistant Trade Commissioner E. C. Taylor, Paris.

Trade agreements have been concluded by the producers of certain types of paper. The newsprint paper industry, it is pointed out, has been organized for years past in the form of a sales comptoir. An agreement with the newsprint paper comptoir and the cardboard industry has virtually been realized, the report states.

The trade agreements referred to are in the form of corporations with variable capital and provide for the regulation of production and an arbitration board for the settlement of disputes. Sales prices are, however, not subject to control, it being expected that the regulation of production will lead to the establishment of normal prices. These agreements also leave each individual firm entire commercial liberty, as any sales prices which may be recommended are not obligatory. The agreements are confined to the distribution of production among the producers on a basis to be determined, the report states.

The manufacture of paper in France, the report points out, is of economic interest to the country from an industrial as well as from an agricultural standpoint. At the present time, there are approximately 200 paper factories in France employing 60,000 workers, with an annual production of approximately 1,200,000 metric tons, and a business turnover of 1½ billion francs (approximately $100,000,000), according to the report.

Pulp and Paper Industry Literature Review

Abstracts of Articles and Patents Compiled by the Abstracts and Bibliography Committee of the Technical Association of the Pulp and Paper Industry, A. Papineau-Couture, John F. Ohlson, C. E. Peterson and Clarence J. West, Chairman

Copies of United States Patents can be obtained from the United States Patent Office, Washington, D. C., for 10 cents each. Send currency, not stamps.

Machinery

Log Barker. Albert Hokonson. U. S. pat. 2,015,936, Oct. 1, 1935.—The machine is constructed so that the logs are allowed to be fed one at a time on to a wide inclined platform and are slid transversely along the same by means of knob-linked chains travelling parallel therewith. Midway along the platform the log is trapped between two other similar sets of moving chains driven to revolve about pivoted guide arms which may be raised or lowered as required. When most of the bark has been cut and torn away, the rear arm is swung down to allow the partially barked log to pass into an endless conveyor which carries it longitudinally towards a rotary swing saw used to cut the log into suitable lengths which fall onto rotating, spirally fluted rolls arranged in pairs so as to rotate and propel the log endwise and to scrub it clean of remaining bark. Rotary conical brushes above these rolls assist in the scrubbing process.—A. P.-C.

Log Barker or Peeler. Rex O. Britton. U. S. pat. 2,016,069, Oct. 1, 1935. The logs supported on two rows of upwardly converging jacks at the upper end of each of which is mounted a horizontal, spiked, rotatable roller by means of which the log is rotated. Removal of the bark is effected by means of horizontal drums which can be moved independently towards or away from the log to adjust themselves to irregularities or variations in diameter. The drums are provided with longitudinal slots into which the knives are fitted and through which the bark is discharged. The drums are mounted on a carriage which can travel longitudinally of the log.—A. P.-C.

Screen Plate. Frank Dustan assignor to William A. Hardy and Sons Co. U. S. pats. 2,015,139, 2,015,140, 2,015,141, Sept. 24, 1935.—The plate is composed of a series of longitudinal sections of slitted sheets of stainless steel, having integral, vertical, downwardly extending side flanges spot welded together. Side sills are welded to the outer side flanges and filling blocks are welded into the end of each section between its flanges.—A. P.-C.

Stock Chest. William B. McMartin assignor to The Noble and Wood Machine Co. U. S. pat. 2,016,647, Oct. 8, 1935.—The invention provides an agitator which will quickly and positively produce a complete intermixing of the stock in a chest with minimum power consumption. This is obtained by combining a worm with a screw propeller having separate blades in such a manner that the worm maintains a constant and positive flow of stock towards a screw propeller of moderate size which in turn, produces not only a violent agitation and intermixing of the material, but in which the tendency to radial outthrow of the stock is prevented by means of a frustro-conical ring which flares outwards in the direction of travel of the stock. A. P.-C.

Paper Machine. Jacob F. Albright. U. S. pat. 2,013,942, Sept. 10, 1935.—In order to prevent the lead strip used in threading the paper through the machine from following the press roll, a small narrow roll is provided that rotates in the same angular direction as and at a higher speed than the press roll, so as to throw the lead strip on to the felt. This roll is mounted so as to be readily withdrawn from contact with the press roll when not in use.—A. P.-C.

Measuring Device. Karl Sieg assignor to Samuel L. Langston Co. U. S. pat. 2,016,581, Oct. 8, 1935.—In a machine for winding paper into rolls of a definite length, a counter wheel engages the paper so as to be rotated thereby. This wheel is mounted so that it may be automatically and instantly moved bodily out of contact with the paper when it is desired to stop the counter, and a brake is provided together with means for causing it to act on the counter whenever the latter is removed from contact with the paper. An electric eye or other suitable device automatically operates the power disconnecting and brake applying devices when the supply of paper is interrupted.—A. P.-C.

Method and Apparatus for Determining, Recording and Controlling Stock Consistency. George S. Witham, Jr. U. S. pat. 2,017,225, Oct. 15, 1935.—A rotatable floating member is mounted in a beater trough, and is constructed so that it will be driven by the stock at substantially the same peripheral speed as the latter. When the level of the stock is kept constant, any change in consistency produces a corresponding change in the velocity of the stock, and hence of the floating member. Suitable electrically operated devices controlled by the speed of the rotating member are provided for indicating and recording the consistency in the beater and for automatically operating the dilution water valve to maintain the consistency constant.

Annunciator Units. Albert Parlett, Jr., Paper Trade J. 101, No. 11, 24 (Sept. 12, 1935).—A brief discussion of the value of annunciator units for detecting abnormal conditions of plant operation.—A. P.-C.

Centrifugal Pulp Purifiers. Louis Aoust. Fr. pat. 778,408.—The invention covers various mechanical features which improve the construction of centrifugal purifiers. The stationary stock inlet consists of two concentric conical tubes which ensure a uniform annular distribution of the stock. Special grates are provided to catch strings and similar long impurities during the upward travel of the material being purified. The rotating bowl is provided with specially shaped radial vanes that carry the layer of stock at the same speed as the bowl. A vertical tube extending inside the bowl is provided with adjustable nozzles by means of which automatic washing under pressure of all parts of the bowl can be effected.—A. P.-C.

Ball and Roller Bearings in the Pulp and Paper Industry. Finnish Paper and Timber J. 17, no. 16:752, 754, 756, 758, 760, 762, 764, 766, 768 (Aug. 31, 1935).—A review of the different applications of such bearings in the pulp and paper industry.—C. J. W.

Modern Paper Cutting Machine and Modern Paper Finishing. J. Brax. Finnish Paper and Timber J. 17, no. 9:464-466, 468, 470, 472-473 (May 15, 1935).—The problems of cutting paper at high speeds are discussed and various modern appliances for increasing production and accuracy of the cutting machines are suggested and criticized.—C. J. W.

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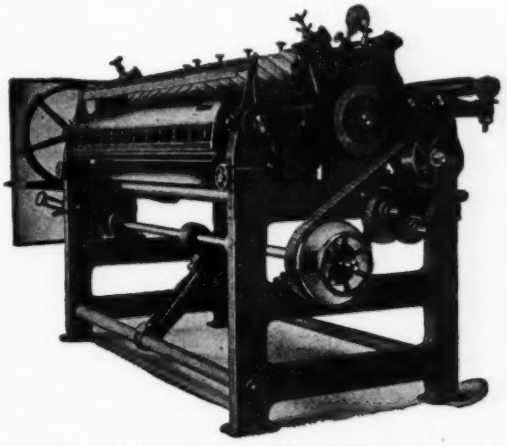

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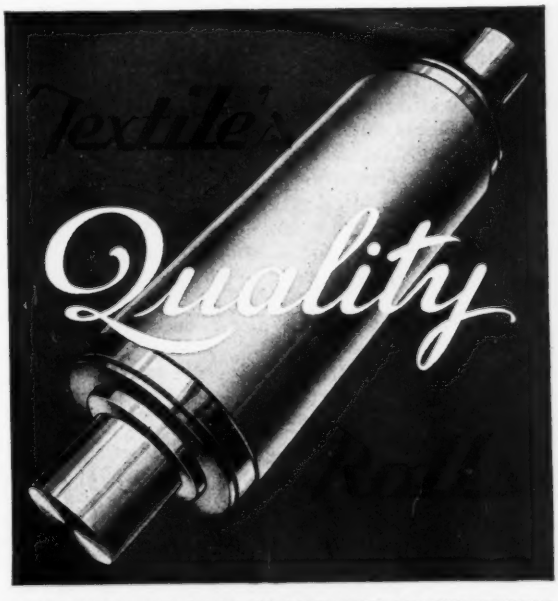

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NEW YORK IMPORTS

WEEK ENDING AUGUST 8, 1936

CIGARETTE PAPER

R. J. Reynolds Tobacco Co., *Pr. Roosevelt,* Havre, 133 cs.; Champagne Paper Corp., *Pr. Roosevelt,* Havre, 55 cs.; Champagne Paper Corp., *Normandie,* Havre, 676 cs.; H. H. Strauss, *Pipestone County,* Bordeaux, 337 cs.

WALL PAPER

Globe Shipping Co., *Deutschland,* Hamburg, 1 cs.; F. J. Emmerich, *Deutschland,* Hamburg, 3 bls.; ———, *Europa,* Bremen, 1cs.

PAPER HANGINGS

W. H. S. Lloyd & Co., *Georgic,* London, 4 bls.

NEWSPRINT

Jay Madden Corp., *Pr. Roosevelt,* Hamburg, 229 rolls; N. Y. Tribune, *Markland,* Liverpool, N. S., 1597 rolls; N. Y. Times, *Markland,* Liverpool, N. S., 299 rolls; World Telegram, *Markland,* Liverpool, N. S., 599 rolls; Clinton Paper Corp., *Markland,* Liverpool, N. S., 620 rolls; International Paper Co., *Humberarm,* Dalhousie, 7242 rolls; International Paper Sales Co., Inc., *Humberarm,* Dalhousie, 588 rolls; Jay Madden Corp., *Manhatgan,* Hamburg, 191 rolls; Jay Madden Corp., *Scanmail,* Kotka, 558 rolls; Lunham & Reeve, Inc., *Scanmail,* Kotka, 139 rolls; Walker Goulard Plehn Co., *Scanmail,* Kotka, 67 bls.; Perkins Goodwin & Co., *Deutschland,* Hamburg, 290 rolls, 29 bls.

PRINTING PAPER

Burroughs Wellcome & Co. *American Trader,* London, 10 cs.; R. J. Saunders Co., *Aquitania,* Southampton, 4 cs.; E. Dietxgen & Co., *Estrella,* Marseilles, 8 cs.; Globe Shipping Co., *Westernland,* Antwerp, 22 cs.; Keller Dorlan Paper Co., *Exeter* Marseilles, 3 cs.; Phoenix Shipping Co., *Deutschland,* Hamburg, 4 cs.; Lansen Naeve Corp., *Deutschland,* Hamburg, 3 cs.; Jay Madden Corp., *Scanmail,* Kotka, 66 bls., 83 rolls.

WRAPPING PAPER

———, *Pr. Roosevelt,* Hamburg, 968 rolls; Jay Madden Corp., *Manhattan,* Hamburg, 9 bls., 192 rolls; Phoenix Shipping Co., *Deutschland,* Hamburg, 5 bls.

PACKING PAPER

A. J. Bullinger, *Black Eagle,* Rotterdam, 8 cs.

FILTER COMPOUND

P. H. Petry & Co., *Manhattan,* Hamburg, 100 bls.

FILTER PAPER

———, *Deutschland,* Hamburg, 3 cs.

DRAWING PAPER

Japan Paper Co., *American Trader,* London, 1 cs.

COLORED PAPER

D. C. Andrews & Co., *Europa,* Bremen, 1 cs.

SURFACE COATED PAPER

Gevaert Co. of America, *Westernland,* Antwerp, 38 cs.; Gevaert Co. of America, *Black Gull,* Antwerp, 59 cs.; ———, *Deutschland,* Hamburg, 2 cs.

BASIC PAPER

Globe Shipping Co., *Europa,* Bremen, 27 cs.; Dingelstedt & Co., *Europa,* Bremen, 7 cs.

PHOTO PAPER

Heemsoth Pinkus & Kerner, *Deutschland,* Hamburg, 2 cs.; Freedman & Slater, *Europa,* Bremen, 3 cs.

DECALCOMANIA PAPER

B. F. Drakenfeld & Co., *Samaria,* Liverpool, 4 cs. (duplex).

DECALCOMANIAS

Sellers Transportation Co., *Deutschland,* Hamburg, 3 cs.; Sellers Transportation Co., *Europa,* Bremen, 2 cs.

TRANSFER PICTURES

Rohner Gehrig & Co., *Europa,* Bremen, 14 cs.

TISSUE PAPER

B. F. Drakenfeld & Co., *Samaria,* Liverpool, 1 cs.; W. J. Byrnes, *American Trader,* London, 3 cs.; W. J. Byrnes, *Aquitania,* Southampton, 2 cs.; Van Oppen & Co., *Exeter,* Genoa, 11 cs.; Globe Shipping Co., *Europa,* Bremen, 9 cs.

PAPER TUBES

———, *Deutschland,* Hamburg, 252 cs.

CARD BOARD

Metropolitan Importing & Manfg. Co., *Pr. Roosevelt,* Hamburg, 13 cs.; ———, *Pr. Roosevelt,* Havre, 12 cs.

STRAW BOARDS

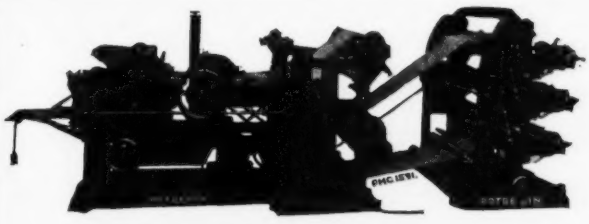
Balfour Guthrie & Co., *Black Eagle,* Rotterdam, 438 pkgs.

MISCELLANEOUS PAPER

Japan Paper Co., *Tai Ping Yang,* Kobe, 65 cs.; Keuffel & Esser Co., *Manhattan,* Hamburg, 36 rolls, 44 cs.; Dingelstedt & Co., *Manhattan,* Hamburg, 22 cs.; Jay Madden Corp., *Scanmail,* Helsingfors, 8 bbls.

RAGS, BAGGINGS, ETC.

J. Cohen Son Co., Inc., *Georgic,* London, 30 bls. rags; ———, *Samaria,* Liverpool, 50 bls. rags; Irving Trust Co., *Pr. Roosevelt,* Hamburg, 98 bls. rags; Darmstadt Scott & Courtney, *Tai Ping Yang,* Kobe, 60 bls. rags; ———, *Tai Ping Yang,* Kobe 360 bls. cotton waste; G. A. Henshaw & Son, *Batory,* Gdynia, 109 bls. rags; ———, *American Trader,* London, 39 bls. rags, 123 bls. paper stock; R. Blank, *Pipestone County,* Havre, 116 bls. rags; W. Steck & Co., *Pipestone County,* Havre, 31 bls. rags; E. J. Keller Co., Inc., *Pipestone County,* ———, 344 bls. rags; J. T. Flannery, *Pipestone County,* Bordeaux, 75 bls. rags; ———, *Waukegan,* Leith, 89 bls. rags; Castle & Overton, Inc., *Waukegan,* Dundee, 85 bls. paper stock; Castle & Overton, Inc., *Estrella,* Barcelona, 53 bls. dark cottons, 72 bls. bagging; ———, *Estrella,* Barcelona, 209 bls. rags; Irving Trust Co., *Siboney,* Vera Cruz, 45 bls. rags; E. J.



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Keller Co., Inc., *Black Eagle,* ———, 322 bls. rags; Banco Coml Italiane Trust Co., *Black Eagle,* Rotterdam, 61 bls. bagging; ———, *Westernland,* Antwerp, 107 bls. rags; D. M. Hicks, Inc., *Westernland,* Antwerp, 74 bls. flax pulp; E. J. Keller Co., Inc., *Black Gull,* ———, 229 bls. flax waste; ———, *Black Gull,* Antwerp, 21 bls. rags; Philadelphia National Bank, *Black Gull,* Antwerp, 255 bls. rags; Irving Trust Co., *Black Gull,* Antwerp, 147 bls. bagging; Darmstadt Scott & Courtney, *Marin Sanudo,* Genoa, 140 bls. rags; R. L. Pritchard Co., *Manhattan,* Hamburg, 167 bls. jute waste; R. Blank, *Exeter,* Alexandria, 286 bls. rags; Banco Coml Italiane Trust Co., *Exeter,* Alexandria, 89 bls. bagging; W. Steck & Co., *Exeter,* Alexandria, 174 bls. bagging; E. J. Keller Co., Inc., *Exeter,* ———, 411 bls. rags, 72 bls. bagging; Darmstadt Scott & Courtney, *City of Flint,* Manchester, 58 bls. rags.

OLD ROPE

Chase National Bank, *American Trader,* London, 45 coils; Banco Coml Italiane Trust Co., *Volendam,* Rotterdam, 45 coils; W. Steck & Co., *Volendam,* Rotterdam, 48 coils.

CASEIN

Balfour Guthrie & Co., *Westernland,* Antwerp, 712 bags; Balfour Guthrie & Co., *Dagrun,* Buenos Ayres, 834 bags; ———, *Eastern Prince,* Buenos Ayres, 834 bags; ———, *Deutschland,* Hamburg, 70 bags.

WOOD PULP

Gottesman & Co., Inc., *Scanmail,* Stockholm, 450 bls. sulphite 76 tons; J. Andersen & Co., *Scanmail,* Stockholm, 600 bls. sulphite 101 tons; M. Sone, *Lucia C,* Trieste, 510 bls. wood pulp; Castle & Overton, Inc., *Deutschland,* Hamburg, 1075 bls. wood pulp 215 tons; ———, *Pr. Roosevelt,* Hamburg, 321 bls. wood pulp 32 tons; ———, *Black Eagle,* Rotterdam, 399 bls. wood pulp 79 tons; ———, *Manhattan,* Hamburg, 243 bls. wood pulp 26 tons.

WOOD PULP BOARDS

Jay Madden Corp., *Scanmail,* Kotka, 103 bls. 19 tons; G. H. MacFadden & Bros., *Deutschland,* Hamburg, 250 bls.

WOOD PULP PASTE BOARDS

Fibre Products Manfg. Co., *Manhattan,* Hamburg, 19 bls.

WOOD PULP SHEETS

———, *Deutschland,* Hamburg, 100 bls.

NEWARK IMPORTS

WEEK ENDING AUGUST 8, 1936

H. G. Craig Co., *Newscarrier,* Donnacona, 352 rolls newsprint.

PORTLAND IMPORTS

WEEK ENDING AUGUST 8, 1936

Pagel Horton & Co., Inc., *Consul Olsson,* Sweden, 6111 bls. wood pulp; Price & Pierce, Ltd., *Consul Olsson,* ———, 150 tons unbleached sulphite; Price & Pierce, Ltd., *Stureholm,* ———, 450 tons unbleached kraft pulp.

BOSTON IMPORTS

WEEK ENDING AUGUST 8, 1936

———, *Samaria* Liverpool, 372 bags hidecuttings; ———, *Samaria,* Liverpool, 14 bls. threadwaste; F. S. Webster Co., Inc., *Samaria,* Liverpool, 11 cs. tissue paper; G. F. Malcolm, Inc., *Samaria,* Liverpool, 8 cs. tissue paper; J. O. Whitten Co., *Black Eagle,* Rotterdam, 10 bls. filter mass; Castle & Overton, Inc., *Black Eagle,* Rotterdam, 155 bls. wood pulp 31 tons; ———, *Black Eagle,* Rotterdam, 10 bls. rags; Cordingley & Co., *Black Eagle,* Rotterdam, 13 bls. rags, 12 bls. threadwaste; Pagel Horton & Co., Inc., *Consul Olsson,* Sweden, 4521 bls. wood pulp; Price & Pierce, Ltd., *Consul Olsson,* ———, 700 tons unbleached sulphite; Price & Pierce, Ltd., *Consul Olsson,* ———, 30 tons unbleached kraft pulp.

PHILADELPHIA IMPORTS

WEEK ENDING AUGUST 8, 1936

Gottesman & Co., Inc., *Laura C,* Trieste, 1275 bls. wood pulp; E. J. Keller Co., Inc., *Pipestone County,* ———, 669 bls. rags; Castle & Overton, Inc., *Pipestone County,* Bordeaux, 273 bls. rags; American & British Chemical Supplies, *Pipestone County,* Bordeaux, 333 bags casein; G. A. Henshaw & Son, *Waukegan,* Manchester, 77 coils old rope; ———, *Waukegan,* Leith, 61 coils old rope; ———, *Waukegan,* Hamburg, 847 rolls wrapping paper; E. J. Keller Co., Inc., *Black Eagle,* ———, 863 bls. rags; ———, *Black Eagle,* Rotterdam, 460 bls. rags; Johaneson Wales & Sparre, Inc., *Scanmail,* Gdynia, 1500 bls. wood pulp 150 tons; Wilkinson Bros. Co., *Scanmail,* Kotka, 69 rolls newsprint; J. W. Hampton, Jr., Co., *Scanmail,* Kotka, 470 rolls newsprint; Price & Pierce, Ltd., *Griesheim,* ———, 100 tons unbleached sulphite.

WILMINGTON IMPORTS

WEEK ENDING AUGUST 8, 1936

Price & Pierce, Ltd., *Griesheim,* ———, 1400 tons unbleached sulphite; Pagel Horton & Co., Inc., *Griesheim,* Sweden, 2100 bls. wood pulp.

BALTIMORE IMPORTS

WEEK ENDING AUGUST 8, 1936

———, *Laura C,* Trieste, 3013 bls. wood pulp; Congoleum Nairn Co., *Pipestone County,* Havre, 374 bls. rags; Congoleum Nairn Co., *Pipestone County,* St. Nazaire, 287 bls. rags; Congoleum Nairn Co., *Pipestone County,* Bordeaux, 161 bls. rags; ———, *Pipestone County,* Havre, 250 bags casein; Washington Post, *Markland,* Liverpool, N. S., 2938 rolls newsprint Pompeian Olive Oil Co., *Estrella,* Marseilles, 15 cs. filter paper; ———, *Lucia C,* Trieste, 2000 bls. wood pulp; Gottesman & Co., Inc., *Svaneholm,* Sweden, 600 bls. wood pulp; Price & Pierce, Ltd., *Belos,* ———, 100 tons unbleached sulphite; Price & Pierce, Ltd., *Belos,* ———, 200 tons ground wood; Price & Pierce, Ltd., *Belos,* ———, 100 tons unbleached kraft pulp; Pagel Horton & Co., Inc., *Belos,* Sweden, 2926 bls. wood pulp.

NORFOLK IMPORTS

WEEK ENDING AUGUST 8, 1936

Price & Pierce, Ltd., *Belos,* ———, 500 tons unbleached sulphite.

NEW ORLEANS IMPORTS

WEEK ENDING AUGUST 8, 1936

Gottesman & Co., Inc., *Vasaholm,* Sweden, 3070 bls. wood pulp.

GALVESTON IMPORTS

WEEK ENDING AUGUST 8, 1936

Gottesman & Co., Inc., *Vasaholm* Sweden, 600 bls. wood pulp.

SAN FRANCISCO IMPORTS

WEEK ENDING AUGUST 8, 1936

Frazar & Co., *Tai Ping Yang,* Yokohama, 300 bls. rags; Scherman Bros., *Tai Ping Yang,* Yokohama, 200 bls. rags.

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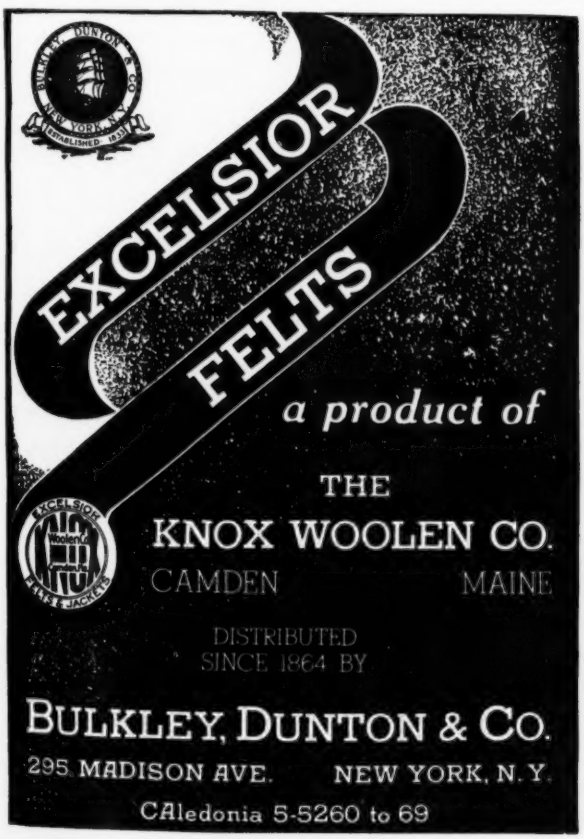

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Covington, Virginia
Tyrone, Pennsylvania
Williamsburg, Pennsylvania
Cass, West Virginia

New York Market Review

Office of the PAPER TRADE JOURNAL,
Wednesday, August 12, 1936.

Business in the local paper market is more active than usual at this time of the year. Demand for the various grades of paper is well sustained. Sales forces of the leading paper organizations are preparing for a busy Fall, while the outlook for the closing months of the year is bright. Prices are steady and unchanged.

The newsprint paper market is displaying strength. Advertising lineage and circulations of the leading newspapers continue to run ahead of last year's record. The opinion is expressed that the action of the Great Northern Paper Company in announcing an advance of $1.50 per ton on contracts for 1937 may not be followed by Canadian producers, who wish to set a higher price to meet increased production costs.

Sentiment in the fine paper market is fairly optimistic. Demand for book, cover, bond and ledger papers is holding up well for the season. Prices are steady to firm. Tissues are moving in good volume. The course paper market is exhibiting a strong undertone. Demand for box board is improving with the approach of Autumn.

Mechanical Pulp

The ground wood pulp market is in a stronger position, due to the unusually dry weather experienced so far this summer. Demand for the paper mills is moderately active. Inquiries for future delivery are fairly numerous, some of which may materialize into good sized orders. Prices are holding to schedule, in most instances.

Chemical Pulp

Steadiness prevails in the chemical pulp market. Bleached sulphite and kraft pulps continue firm. More interest is being shown in unbleached sulphite, especially the bleachable grades. Bleached soda pulp is steady. Prices of the various domestic and imported grades of chemical pulp are holding to formerly quoted levels.

Old Rope and Bagging

The old rope market is rather quiet. Demand for foreign and domestic old manila rope is restricted. Mixed strings are moving slowly. Old rope prices remain unchanged. Some improvement transpired in the bagging market. Scrap and gunny bagging are in fairly good request for the time of year. Gunny bagging is listless at present.

Rags

Conditions in the domestic rag market are little changed. Demand for new and old cotton rags is light. Some grades are in moderate request for export. Roofing rags are seasonally quiet. Quotations on domestic rags are fairly steady. With prices of rags abroad high and offerings limited, the imported rag market here is dull.

Waste Paper

The paper stock market is showing definite signs of improvement. Board mill demand for the lower grades is fairly persistent, with the busy operating season near at hand. Prices of strictly folded news and No. 1 mixed paper are firmer. The higher grades of waste paper are in satisfactory request. Prices are generally well maintained.

Twine

No radical changes transpired in the domestic twine market during the past week. Demand for the various varieties is considered excellent for the season. Inquiries for future needs are fairly numerous. The outlook for the closing months of the year is encouraging. Prices are holding to schedule.

Settles Paper Labor Case

WASHINGTON, D. C., August 12, 1936.—The National Labor Relations Board in a statement telling of cases settled through its work refers to the following paper case.

A paper manufacturer was charged by the Brotherhood of Pulp, Sulphite and Paper Mill Workers with laying off 64 of its members for union activity. A regional examiner of the Board conferred with the union and with the employer, and as a final result a strike begun in April was ended on June 15 with the reopening of the plant on terms satisfactory to both parties.

The announcement states that the company agreed to cut the work schedule five hours a week with wages remaining the same as on the previous schedule, to take back the strikers, not to discriminate against any employees because of their desire to join or not to join a union, and to grant specific holidays.

Celebrates Golden Anniversary

[FROM OUR REGULAR CORRESPONDENT]

PAWTUCKET, R. I., August 3, 1936—The John W. Little Company, manufacturer of labels, bands, tags, etc., is celebrating its 50th year of business. This concern has grown from a small, one-press print shop to its present five-story brick factory. Stewart and Arthur Little, sons of John W. Little, founder of the business, carry on the business of the company.

WEST VIRGINIA INSTALLING NEW POWER PLANT

(Continued from page 54)

provision has been made for Federal surtaxes on undistributed profits.

The Union Supply Paper Company of Wilkes-Barre, Pa., and the Wyoming Paper Company of Wyoming, Pa., have been elected to membership in the Course Paper Division of the Paper Trade Association of Philadelphia.

Announcement is made of the appointment of Paper Merchants, Inc., 140 North 6th Street, as agent for Millers Falls Opaque—the new line of highly opaque bond manufactured by Millers Falls Paper Company.

Have YOU Seen Bulletin 953?

"Buffalo"

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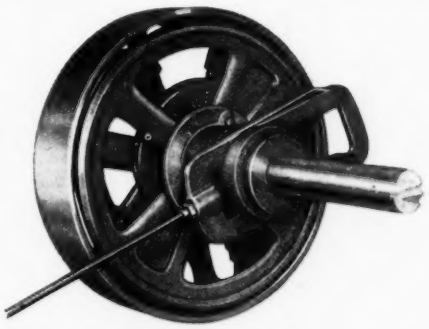

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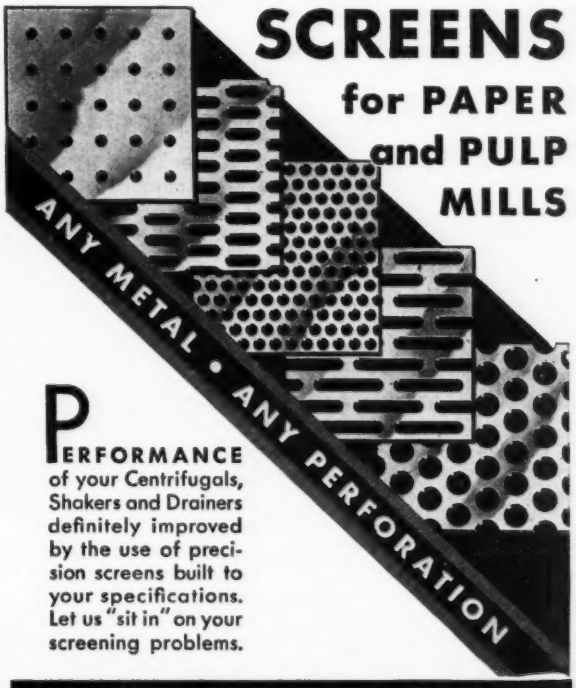
A unit which permits machine operator to start equipment at lowest possible speed, increasing it as desired to maximum. Will operate indefinitely at any range of speed between start and maximum.

Makes variable speed motors unnecessary. Governors built in clutch will automatically take up any speed variation, preventing broken webs of paper on winders, slitters, printers, bag machines and similar converting units. Will pay for itself in three months of service.

Write for circulars and descriptive matter.

HUDSON-SHARP MACHINE COMPANY
Green Bay, Wisconsin



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The Economy Chuck is a time and labor saver. It permits use of lightest non-returnable core. It insures complete unwinding at maintained speed. Available for all sizes of shafts and kinds of cores. Prices and complete description will be sent upon request. Write now.

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AVOID delays in your finishing processes by putting your calenders, platers and other equipment in modern condition now. Ask our engineering department to work with you on repairs, alterations or replacements.

Norwood Engineering Co. Florence, Mass.

Miscellaneous Markets

Office of the PAPER TRADE JOURNAL,
Wednesday, August 12, 1936.

BLANC FIXE.—The blanc fixe market is moderately active. Prices are holding to formerly quoted levels. The pulp is offered at $42.50 to $45 per ton, in bulk; while the powder is selling at 3½ to 3¾ cents per pound, in barrels, at works.

BLEACHING POWDER.—Conditions in the bleaching powder market are fairly satisfactory. The contract movement is about average for the time of year. Prices remain unchanged. Bleaching powder is quoted at $2 to $2.25 per 100 pounds, in drums, at works.

CASEIN.—The casein market continues firm. Domestic standard ground is quoted at 16½ and finely ground at 17 cents; while French and Argentine standard ground are selling at 17 and finely ground at 17½ cents per pound, all in bags, car lot quantities.

CAUSTIC SODA.—Steadiness prevails in the caustic soda market. Supplies are moving into consumption in good volume. Solid caustic soda is quoted at $2.55 to $2.60; while the flake and ground are selling at $2.95 to $3 per 100 pounds, in drums, at works.

CHINA CLAY.—The china clay market is exhibiting a fairly strong undertone. Prices are holding to schedule. Imported china clay is quoted at $12.50 to $21 per ton, ship side; while domestic paper making clay is offered at $6.50 to $12 per ton, at mine.

CHLORINE.—The chlorine market is displaying strength. Demand from the paper mills is fairly brisk. The contract movement is regular. Prices remain unchanged. Chlorine is quoted at $2.15 to $2.55 per 100 pounds, in tank cars, at works.

ROSIN.—The rosin market is stronger. Paper making gum rosin is now quoted at $6.05 and wood rosin at $6.15 per 280 pounds, gross weight, in barrels, at Savannah. Seventy per cent rosin size is selling at $2.95 per 100 pounds, in tank cars, at works.

SALT CAKE.—Paper mill demand for salt cake is persistent. The contract movement is normal. Salt cake is still quoted at $12 to $13; chrome salt cake at $11 to $12 per ton, at works; while imported salt cake is selling at $12 to $13 per ton, ship side.

SODA ASH.—The soda ash market is in a strong position. Contract shipments are moving freely. Prices remain unchanged. Quotations on soda ash, in car lots, at works, per 100 pounds, are as follows: in bulk, $1.05; in bags, $1.20; and in barrels, $1.50.

STARCH.—Due to the advance in raw materials, the starch market is firmer. The contract movement is fairly heavy. Prices are higher. Special paper making starch is now quoted at $4 per 100 pounds, in bags; and at $4.27 per 100 pounds, in barrels, at works.

SULPHATE OF ALUMINA.—The position of the sulphate of alumina market is strong. Contract shipments are moving in good volume. Prices remain unchanged. Commercial grades are quoted at $1.35 to $1.60; and iron free at $2 to $2.25 per 100 pounds, in bags, at works.

SULPHUR.—The sulphur market continues steady. Yearly contracts are quoted at $18 per ton, in bulk, on orders of 1,000 tons, or over, and $20 on smaller quantities. On spot and nearby car loads the quotation is $21 per ton. All quotations are in car lots, at works.

TALC.—Business in the talc market is satisfactory for the season. Prices are generally holding to formerly quoted levels. Domestic talc is quoted at $16 to $18 per ton, at eastern mines; while imported talc is selling at $23 to $30 per ton, on dock.

Market Quotations

Paper

Rag Content Bond & Ledgers— Delivered Zone 1	Bonds		Ledgers
100% Rag Ext. No. 1	.36		.37
100% Rag	.28		.29
75% Rag	.21		.22
65% Rag	.18		.19
50% Rag	.15		.16
25% Rag	.12½		.13½

Sulphite Bond & Ledgers— Delivered Zone 1	Bonds		Ledgers
No. 1 Sulphite	7.50	@	8.50
No. 2 Sulphite	6.50	@	7.50
No. 3 Sulphite	6.00		7.00
No. 4 Sulphite	5.50		6.50
Book, B Grade, Cased			
S. & S. C.	5.85	@	6.60
S. & S. C. Litho.	6.10	@	6.85
M. F.	5.60	@	6.35
No. 4 Grade			
Coated and Enamel	6.80	@	7.65
Coated Litho	6.80	@	7.65
Tissues—Per Ream—			
White No. 1	.82½	@	—
White No. 1 M. G.	.77½	@	—
White No. 1½	.62½	@	—
White No. 2	.60	@	—
Anti-Tarnish M. G.	.67½	@	—
Colored	.80	@	—
Kraft	.67½	@	—
Manila	.60	@	—
Unbleached Toilet	2.60	@	3.30
Bleached Toilet	3.94	@	5.26
Paper Towels—			
Unbleached	2.10	@	3.35
Bleached	3.30	@	3.70
Manila—			
No. 1 Jute	9.00	@	9.25
No. 2 Jute	7.75	@	8.50
No. 1 Wood	4.00	@	5.25
No. 2 Wood	3.50	@	4.00
Fibre Papers—			
No. 1 Fibre	4.25	@	5.50
No. 2 Fibre	4.00	@	4.75

(Delivered New York)

News, per ton—			
Roll, contract	41.00	@	—
Sheets	46.00	@	—
Kraft—			
No. 1 Northern	4.25	@	4.75
Standard	4.12½	@	—
Southern	4.00	@	—
Boards—per ton—			
News	32.50	@	35.00
Chip	32.50	@	35.00
Sgl. Mla. Ll. Chip	45.00	@	47.50
Jute Lined Chip	42.50	@	45.00
Kraft Liners	60.00	@	62.50
White Pat. Coated	57.50	@	60.00
Binders Boards	67.00	@	75.00

Mechanical Pulp

(On Dock, Atlantic Ports)

No. 1 Imported—			
Moist	24.00	@	25.00
Dry	24.00	@	25.00

(Delivered)

No. 1 Domestic and Canadian	27.00	@	28.00

Chemical Pulp

(On Dock, Atlantic, Gulf and West Coast Ports)

Bleached Sulphite (Domestic and Foreign)—			
Division 1	2.70	@	3.30
Division 2	2.65	@	2.75
Division 3	2.60	@	2.70
Prime Qualities—			
Class 1. All Prime Easy Bleaching	2.05	@	2.10
Other Than Easy Bleaching—			
Class 2. Higher than Standard	2.00	@	2.05
Class 3, Standard	1.95	@	2.00
Class 4. Lower than Standard	1.90	@	1.95

(On Dock, Atlantic Ports)

Kraft Bleached	3.00	@	3.25
Kraft Light & Strong	2.10	@	2.20
Kraft No. 1	1.85	@	2.10
Kraft No. 2	1.70	@	1.85

(F. o. b. Pulp Mill)

Kraft Domestic	1.80	@	2.00

(Delivered)

Soda Bleached	2.60	@	—

• Add 60 Cents per short ton, dock charges, for Albany; $2.00 for Lake Ports East and $3.00 for Lake Ports West of Mackinac Straits.

Domestic Rags

New Rags

(Prices to Mill f. o. b. N. Y.)

Shirt Cuttings—			
New White, No. 1	7.50	@	7.75
Silesias No. 1	5.50	@	5.75
New Unbleached	8.25	@	8.50
New Soft Blacks	3.75	@	4.00
Blue Overall	6.50	@	6.75
Fancy	3.00	@	3.25
Washables	2.25	@	2.50
Mixed Khaki Cuttings	3.50	@	3.75
O. D. Khaki Cuttings	4.25	@	4.50
Men's Corduroy	2.00	@	2.25
New Mixed Blacks	2.75	@	3.00

Old Rags

White, No. 1—			
Repacked	3.25	@	3.50
Miscellaneous	2.75	@	3.00
White, No. 2—			
Repacked	2.25	@	2.50
Miscellaneous	1.75	@	2.00
Thirds and Blues—			
Repacked	2.00	@	2.25
Miscellaneous	1.90	@	2.00
Roofing Rags—			
No. 1	1.75	@	1.80
No. 2	1.15	@	1.25
No. 3 (bagging)	1.10	@	1.15
No. 4	1.10	@	1.15
No. 5A	.80	@	.90

Foreign Rags

New Rags

New Dark Cuttings	2.25	@	2.50
New Mixed Cuttings	2.00	@	2.25
New Light Silesias	4.50	@	5.00
Light Flannelettes	4.50	@	5.00
New White Cuttings	7.00	@	7.50
New Light Oxfords	4.00	@	4.50
New Light Prints	3.00	@	3.25

Old Rags

No. 1 White Linens	7.50	@	8.00
No. 2 White Linens	6.50	@	7.00
No. 3 White Linens	4.50	@	5.00
No. 4 White Linens	2.25	@	2.50
No. 1 White Cotton	4.25	@	4.75
No. 2 White Cotton	3.25	@	3.75
No. 3 White Cotton	2.50	@	2.75
No. 4 White Cotton	1.90	@	2.15
Extra Light Prints	2.00	@	2.25
Ord. Light Prints	1.75	@	1.85
Med. Light Prints	1.55	@	1.65
Dutch Blue Cottons	2.25	@	2.50
French Blue Linens	3.50	@	4.00
German Blue Linens	2.50	@	2.75
German Blue Cottons	2.00	@	2.25
Checks and Blues	2.00	@	2.25
Linsey Garments	2.15	@	2.25
Dark Cottons	1.90	@	2.10
Old Shopperies	1.75	@	2.00
New Shopperies	1.75	@	2.00
French Blues	2.25	@	2.50

Old Rope and Bagging

(Prices to Mill f. o. b. N. Y.)

Gunny No. 1—			
Foreign	2.10	@	2.15
Domestic	1.75	@	1.85
Wool Tares, light	1.50	@	1.75
Wool Tares, heavy	1.85	@	2.05
Bright Bagging	1.70	@	1.75
Manila Rope—			
Foreign	2.40	@	2.60
Domestic	2.25	@	2.50
Mixed Strings	1.10	@	1.15
New Burlap Cut	2.75	@	3.00
Hessian Jute Threads—			
Foreign	3.00	@	3.25
Domestic	2.80	@	3.00

Old Waste Papers

(F. o. b. New York)

Shavings—			
White Envelope Cuttings	2.55	@	2.65
Ordinary Hard White No. 1	2.25	@	2.35
Hard White No. 2	2.10	@	2.20
Soft White No. 1	1.95	@	2.05
Flat Stock—			
Stitchless	.65	@	.75
Over issue Mag	.65	@	.75
Solid Flat Book	.55	@	.60
Crumpled No. 1	.35	@	.40
Solid Book Ledger	1.50	@	1.65
Ledger Stock	.85	@	.90
New B. B. Chips	.30	@	.35
Manilas—			
New Env. Cut	1.75	@	1.85
New Cuttings	1.35	@	1.45
Bogus Wrapper	.40	@	.50
Old Kraft Machine— Compressed bales	1.05	@	1.30
News—			
No. 1 White News	1.15	@	1.25
Strictly Overissue	.50	@	.60
Strictly Folded	.35	@	.40
No. 1 Mixed Paper	.30	@	.35

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Perforated Metal Screens
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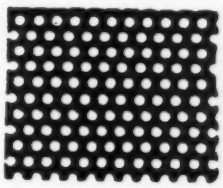

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EMBOSSING ROLLERS

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THE CORROSION RESISTANT ALLOY
CAST • ROLLED • FABRICATED
for all equipment exposed to corrosion by sulphite acids
MICHIGAN STEEL CASTING CO. DETROIT, MICH

Twines

(F. o. b. Mill)

(Soft Fibre)

Coarse Polished—			
India	.13¼	@	.15¾
Belg. White Hemp	.14¼	@	.17¾
India Compress	.13¾	@	.14¼
Fine Polished—			
Fine India	.21½	@	.23½
Special	.19½	@	.21½
Unpolished—			
Box	.12	@	.12½
Paper Makers	.09	@	.13½
Tube Rope	.10	@	.15½
Wall Paper	.11	@	.14½
Wrapping	.15½	@	.21
Special	.15	@	.15½
Soft Fiber Rope	.12½	@	.12¾

(Hard Fibre)

Bond	.09½	@	.18
Anchor	.09	@	.10½
Manila	.21	@	.28

CHICAGO

Paper

(F. o. b. Mill)

Rag Bond	.12	@	.40
Water Marked Sulphite Bond	.06¾	@	.11
Sulphite Bond	.05½	@	.07¾
Superfine Writing	.18	@	.24
No. 1 M. F. Book	.06½	@	.07¾
No. 2 M. F. Book	.05¼	@	.06¼
No. 1 S.&S.C. Book	.06¾	@	.07¾
No. 2 S.&S.C. Book	.05¾	@	.06½
Coated Book	.07	@	.12
Coated Label	.07	@	.08½
No. 1 Manila	.04¼	@	.05¾
No. 1 Fibre	.04¾	@	.05¼
No. 2 Manila	.04¼	@	.04¾
Butcher's Manila	.03¼	@	.03¾
No. 1 Kraft	4.75	@	5.00
Southern Kraft	3.88	@	4.25
No. 2 Kraft	3.88	@	4.25
Wood Tag Boards	.04¼	@	.06¼
Sulphite Screenings	.03	@	.03¼
Manila Tissue	.05¾	@	.07
White Tissue	.07	@	.09

(Delivered Central Territory)

News, per ton—			
Rolls, contract	42.00	@	—
Sheets, open	47.00	@	—
Boards, per ton—			
Plain Chip	46.50	@	—
Solid News	50.00	@	—
Manila Lined Chip	55.00	@	—
Patent Coated	65.00	@	—
Container Lined—			
85 Test, per 1000 sq. ft.			1.70
100 Test, per 1000 sq. ft.			1.85

Old Papers

(F. o. b. Chicago)

Shavings—			
No. 1 White Envelope Cuttings	1.70	@	2.00
No. 1 Hard White	1.40	@	1.65
No. 1 Soft White	1.25	@	1.50
Ledger & Writings	.60	@	.70
Solid Books	.50	@	.60
Blanks	1.00	@	1.05
Krafts	.80	@	.90
New Kraft Cuts	1.20	@	1.30
Manila Env. Cuts	1.25	@	1.30
Ex. No. 1 Manila	.90	@	1.00
Print Manila	.40	@	.50
Overissue News	.40	@	.45
Old Newspapers—			
No. 1 Folded News	.42½	@	.45
No. 1 Mixed Paper	.25	@	.30
Roofing Stocks—			
No. 1	30.00	@	—
No. 2	28.00	@	—

PHILADELPHIA

Paper

Rag Content Bond & Ledgers— Delivered Zone 1	Bonds	Ledgers
100% Rag Ext. No. 1	.36	.37
100% Rag	.28	.29
75% Rag	.21	.22
65% Rag	.18	.19
50% Rag	.15	.16
25% Rag	.12½	.13½
Sulphite Bond & Ledgers— Delivered Zone 1		
No. 1 Sulphite	7.75	8.75
No. 2 Sulphite	6.75	7.75
No. 3 Sulphite	6.00	7.00
No. 4 Sulphite	5.50	6.50

F.o.b. Mill

Book, M. F.	5.00	@	—
Book, S. S. & C.	5.25	@	—
Book, Coated	6.15	@	—
Coated Lithograph	6.15	@	—
No. 1 Jute Manila	10.50	@	—
Manila Sul., No. 1	6.75	@	—
Manila No. 2	4.25	@	—
No. 1 Kraft	6.00	@	—
Southern Kraft	5.00	@	—
News Print Rolls	40.00	@	—
Straw Board	40.00	@	45.00
News Board	40.00	@	—
Chip Board	37.50	@	—
Wood Pulp Board	70.00	@	85.00
Binder Boards—			
No. 1, per ton	75.00	@	80.00
No. 2, per ton	70.00	@	75.00
Carload lots	65.00	@	70.00
Tarred Felts—			
Regular	52.25	@	54.25
Slaters (per roll)	.84	@	.94

Domestic Rags (New)

(Price to Mill, f. o. b. Phila.)

Shirt Cuttings—			
New White, No. 1	.08	@	.08¼
New White, No. 2	.04½	@	.05
Light Silesias	.05½		—
Silesias, No. 1	.04½	@	.05
Black Silesias, soft	.03½	@	.04
New Unbleached	.06	@	—
Washable, No. 1	.02	@	.02½
Blue Overall	.06	@	.06½
Cottons—According to grades—			
Washable, No. 2	.02½	@	.04½
New Blue	.01¾	@	.02¼
Fancy	.03	@	—
New Black Soft	.04	@	.04½
New Light Seconds	.03½	@	.04
New Dark Seconds	1.75	@	2.00
Khaki Cuttings—			
No. 1 O. D.	.04	@	.04½
No. 2 Mixed	.03½	@	.04
Corduroy	.02	@	.02¼
New Canvas	.04	@	.04½
New Black Mixed	.02	@	.02¼

Domestic Rags (Old)

White No. 1—			
Repacked	4.00	@	4.50
Miscellaneous	3.00	@	3.50
Thirds and Blues—			
Miscellaneous	2.00	@	—
Repacked	2.25	@	2.50
Black Stockings (Export)	4.50	@	5.00
Roofing Stock—			
Foreign No. 1	2.20	@	2.25
Domestic No. 1	1.50	@	—
Domestic No. 2	1.40	@	—
Roofing bagging	1.10	@	—

Bagging

(F. o. b. Phila.)

Gunny, No. 1—			
Foreign	2.00	@	—
Domestic	2.25	@	—
Manila Rope	2.25	@	2.50
Sisal Rope	2.00	@	2.25
Mixed Rope	1.00	@	1.10
Scrap Burlaps—			
No. 1	2.00	@	2.50
No. 2	.90	@	1.00
Wool Tares, heavy	3.00	@	3.25
Mixed Strings	1.00	@	1.10
No. 1 New Light Burlap	3.00	@	3.50
New Burlap Cuttings	2.50	@	2.75

Old Papers

(F. o. b. Phila.)

Shavings—			
No. 1 Hard White	2.30	@	2.40
No. 2 Hard White	2.10	@	2.20
No. 1 Soft White	1.80	@	1.85
No. 2 Soft White	1.40	@	1.45
No. 1 Mixed	—	@	.85
Solid Ledger Stock	1.50	@	1.60
Ledger Stock, white	1.15	@	1.20
Ledger Stock, colored	.85	@	.90
No. 1 Books, heavy	.65	@	.70
Manila Cuttings	1.50	@	1.60
Print Manila	.50	@	.60
Container Manila	.50	@	.60
Kraft Paper	1.10	@	1.20
No. 1 Mixed Paper	.35	@	.40
Straw Board Chip	.40	@	—
Binders Board Chip	.40	@	—
Corrugated Board	.60	@	.65
Overissue News	.60	@	—
Old Newspapers	.40	@	—

BOSTON

Paper

Rag Content Bond & Ledgers— Delivered Zone 1	Bonds	Ledgers
100% Rag Ext. No. 1	.36	.37
100% Rag	.28	.29
75% Rag	.21	.22
65% Rag	.18	.19
50% Rag	.15	.16
25% Rag	.12½	.13½
Sulphite Bond & Ledgers— Delivered Zone 1		
No. 1 Sulphite	7.50	8.50
No. 2 Sulphite	6.50	7.50
No. 3 Sulphite	6.00	7.00
No. 4 Sulphite	5.50	6.50

F.o.b. Mill

Book, Super	.06	@	.09
Book, M. F.	.05½	@	.08½
Book, Coated	.08½	@	.18
Coated Litho	.09	@	.12
Jute Manila No. 1	.11	@	.13
Manila, Sul. No. 1	.04¾	@	.06¼
Manila, Sul. No. 2	.03¾	@	.04½
No. 1 Kraft	.04¼	@	—
No. 2 Kraft	.04⅛	@	—
(Delivered New England points)			
Southern Kraft	.04	@	—
News Print Rolls	39.50	@	—
Straw Board, rolls	.009	@	35.00
Filled News Board	40.00	@	45.00
Chip Board	37.50	@	40.00
Single Manila Lined Chip	47.50	@	52.50
Single White, Patent Coated News Board (Bender)	55.00	@	65.00
Wood Pulp Board	70.00	@	75.00
Binder Boards (Standard Grade)	67.00	@	75.00

Old Papers

(F. o. b. Boston)

Shavings—			
No. 1 Hard White	2.00	@	2.10
No. 1 Soft White	1.75	@	1.85
No. 2 Mixed	.75	@	.80
Solid Ledger Books	1.50	@	1.75
Overissue Ledger Stock	1.15	@	1.30
Mixed Ledgers	.85	@	.90
No. 1 Books, heavy	.60	@	.70
No. 1 Books, light	.50	@	.60
Crumpled Stitchless Book Stock	.50	@	.60
Manila Env. Cuttings	1.50	@	1.60
No. 1 Old Manila	.60	@	.65
White Blank News	1.10	@	1.15
No. 1 Kraft	1.05	@	1.12½
Mixed Papers	.30	@	—
Print Manila	.47½	@	.50
Container Manilas	.27½	@	—
Old Newspapers	.32½	@	—
Overissue News	—	@	.40
Box Board Chips	—	@	.25
Corrugated Boxes	.47½	@	.50
Kraft corrugated boxes	.95	@	1.00
Screening Wrappers	.40	@	.45

Bagging

(F. o. b. Boston)

Manila Rope—			
Foreign	2.35	@	2.45
Domestic	2.25	@	—
Transmission Rope	1.20	@	1.30
Jute Rope	1.90	@	2.10
Jute Carpet Threads	1.00	@	1.10
Gunny No. 1—			
Foreign	1.90	@	2.00
Domestic	1.75	@	1.80
Bleachery Burlap	4.25	@	4.50
Scrap Burlap—			
Foreign	1.90	@	2.00
Domestic	1.60	@	1.75
Scrap Sisal	1.90	@	2.00
Scrap Sisal for Shredding	2.10	@	2.25
Wool Tares, heavy	1.90	@	2.00
New Burlap Cuttings	2.00	@	2.25
Australian Wool Pouches	2.25	@	2.35
Heavy Baling Bagging	1.75	@	2.10
Paper Mill Bagging	1.65	@	1.70
Bagging No. 2	1.10	@	1.25

Domestic Rags (New)

(F. o. b. Boston)

Shirt Cuttings—			
New Light Prints	.01¾	@	.02
New White No. 1	.07	@	.07½
New White No. 2	.04	@	.04¼
Silesias No. 1	.05	@	.05½
New Black Silesias	.03½	@	.04¼
Soft Unbleached	.07¼	@	.07¾
Blue Cheviot	5.50	@	6.00
Fancy	.02½	@	.02¾
Washable	.0165	@	.0170
Cottons—According to grades—			
Blue Overalls	5.50	@	6.00
New Black, soft	.04	@	.04¼
Khaki Cuttings	.04	@	.04¾
O. D. Khaki	.03¾	@	.04¾
Corduroy	.01¾	@	.02
New Canvas	—	@	.05
B.V.D. Cuttings	—	@	.06¾

Domestic Rags (Old)

(F. o. b. Boston)

Canvas	.04½	@	—
White No. 1—			
Repacked	—	@	2.75
Miscellaneous	2.50	@	2.75
White No. 2—			
Repacked	1.90	@	2.00
Miscellaneous	2.00	@	2.25
Twos and Blues	1.75	@	2.00
Thirds and Blues—			
Repacked	1.37½	@	1.75
Miscellaneous	1.25	@	1.62½
Black Stockings	3.90	@	4.00
Roofing Stock—			
No. 1	1.30	@	1.40
No. 2	1.20	@	1.25
No. 3	—	@	1.15

Foreign Rags

(F. o. b. Boston)

Dark Cottons	1.50	@	1.70
New White Shirt Cuttings	6.50	@	6.75
Dutch Blues	2.25	@	2.50
New Checks & Blues	2.50	@	3.00
Old Fustians	1.75	@	1.90
Old Linsey Garments	1.75	@	2.00
New Silesias	5.00	@	5.75

TORONTO

Paper

(F. o. b. Mill)

Bond—			
No. 1 Sulphite	.11	@	—
No. 2 Sulphite	.08½	@	—
No. 1 Colored	.12	@	—
No. 2 Colored	.09	@	—
Ledgers			
Ledgers, No. 1	.34½	@	—
Ledgers, No. 2	.25½	@	—
Writing	.09	@	.09½
Book—			
No. 1 M. F. (Carloads)	6.50	@	—
No. 2 M. F. (Carloads)	6.00	@	—
No. 3 M. F. (Carloads)	6.00	@	—
No. 1 S. C. (Carloads)	7.00	@	—
No. 2 S. C. (Carloads)	6.50	@	—
No. 3 S. C. (Carloads)	6.50	@	—
No. 1 Coated and Litho	12.00	@	—
No. 2 Coated and Litho	10.50	@	—
No. 3 Coated and Litho	9.50	@	—
Coated tinted	13.00	@	—
Wrapping—delivered—			
Rag Brown	4.75	@	—
White Wrap	3.50	@	—
"B" Manila	4.80	@	—
No. 1 Manila	5.40	@	—
Fiber	5.40	@	—
Kraft, M. F.	5.90	@	—
Kraft, No. 2	5.40	@	—

(F. o. b. Cars Toronto)

News, per ton—			
Rolls (contract)	40.50	@	—
Sheets	45.00	@	—

Pulp

Ground wood	27.00	@	—
Unbleached Sulphite	42.00	@	—
Book (Class 1)	58.00	@	—
Writing (Class 2)	59.00	@	—
Select (Class 3)	60.00	@	—

Old Waste Paper

(In carload lots, f. o. b. Toronto)

Shavings—			
White Env. Cut	2.00	@	2.25
Soft White	1.60	@	1.90
White Blk. News	1.25	@	1.40
Book and Ledger—			
Flat Magazine and Book Stock (old)	.80	@	.90
Light and Crumpled Book Stock	.70	@	.80
Leagers and Writings	.90	@	1.00
Manilas—			
New Manila Cut	1.25	@	1.40
Printed Manilas	.50	@	—
Krait	1.00	@	1.60
News and Scrap—			
Strictly Overissue	.55	@	—
Strictly Folded	.50	@	—
No. 1 Mixed Paper	.40	@	—

Domestic Rags

(Price to mills, f. o. b. Toronto)

No. 1 White Shirt Cuttings	.07½	@	.07¾
Fancy Shirt Cuttings	.02¾	@	.03